WATER RESOURCES INVESTIGATION

EDWARD MacDOWELL LAKE

NUBANUSIT BROOK, WEST PETERBOROUGH, N.H.

MERRIMACK RIVER BASIN

REVIEW OF

OPERATIONS

OF

EXISTING PROJECT

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DAEN-CWP-E (4 Sep 75) 1st Ind
SUBJECT: Review of Operations of Existing Project, Edward MacDowell Lake, West Peterborough, New Hampshire

DA, Office of the Chief of Engineers, Wash. D. C. 20314 3 Nov 75

TO: Division Engineer, New England ATTN: NEDPL-P

Recommendations presented in the report are approved.

FOR THE CHIEF OF ENGINEERS:

all incl wd

ALEX SHWAIKO
Acting Chief, Planning Division
Directorate of Civil Works

EDWARD MACDOWELL LAKE

NUBANUSIT BROOK, WEST PETERBOROUGH, N.H.

MERRIMACK RIVER BASIN

REVIEW OF

OPERATIONS OF

EXISTING PROJECT

Department of the Army
New England Division, Corps of Engineers
Waltham, Massachusetts

AUGUST 1975

Frontispiece

Edward MacDowell Dam

SYLLABUS

This report reviews the operations of the existing Edward MacDowell Lake Flood Control Project located on the Nubanusit Brook, one-half mile upstream of the village of West Peterborough, New Hampshire.

The review was authorized by the Flood Control Act of 1970 (Title II of Public Law 91-611) Section 216.

The project was reexamined in light of up-dated design criteria, population increases and local economy changes which occurred since construction was completed in 1950. Investigations included: hydrology and flood regulation, water quality, operations, real estate, foundations and materials, environmental impact, and structural analysis.

Real estate studies revealed that 131 acres of flowage easements downstream of the spillway were not acquired at the time of construction. Purchase of the needed easements began in November 1974 and was completed in July 1975.

A detailed structural analysis of the stilling basin walls, spillway and spillway walls revealed that minor modifications would be needed to meet up-dated design criteria. Remedial measures will be given further consideration under the Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures, as directed by ER1110-2-110.

Federal, State, municipal and other interests feel there is no need for increased recreational facilities or a change in the operations of the flood control project.

The Division Engineer recommends that no reformulation of the operations of the existing project be made at this time.

EDWARD MACDOWELL LAKE

NUBANUSIT BROOK, WEST PETERBOROUGH, N. H.

MERRIMACK RIVER BASIN

REVIEW OF OPERATIONS OF EXISTING PROJECT

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EDWARD MACDOWELL LAKE

NUBANUSIT BROOK, WEST PETERBOROUGH, N.H.

MERRIMACK RIVER BASIN

REVIEW OF OPERATIONS OF EXISTING PROJECT

A. THE STUDY AND THE REPORT

1. GENERAL

On 11 April 1975, the name of the existing project was changed from the Edward MacDowell Dam to the Edward MacDowell Lake. The reason for the change was due to the fact that the impoundment behind the dam is now being permanently controlled by the dam gates (since modification of the downstream, Verney Mills Dam in 1974). The permanent pool is being maintained for aesthetics, wildlife habitat, and environmental enhancement. The reservoir is operated for flood control purposes, as a unit of a comprehensive plan for flood control and other purposes in the Merrimack River Basin.

2. PURPOSE

The purpose of this report is to review the operations of the Edward MacDowell Lake project, due to changed conditions since the project was completed 25 years ago. The changed conditions are up-dated design criteria, population, and local economy. Significant changes have taken place with respect to design for earthquake, uplift, and sliding factor of safety.

This study was undertaken to:

a. Assure that the existing Corps of Engineers project is operationally safe as well as being structurally sound in accordance with the most recent criteria;

b. Examine the current environment and determine the need for modifying or altering project operation to insure compatability with environmental considerations;

c. Reformulate project objectives if necessary so that the project will continue to best serve the Nation's economy;

d. Examine real estate holdings for any necessary acquisition or disposition of property.

e. Recommend modifications to structures, operation, or environmental aspects where necessary.

3. AUTHORITY

The study of the existing MacDowell project and the preparation of this report was authorized by the Flood Control Act of 1970 (Title II of Public Law 91-611) Section 216; which reads as follows:

"The Secretary of the Army, acting through the Chief of Engineers, is authorized to review the operation of projects constructed by the Corps of Engineers in the interest of navigation, flood control, water supply, and related purposes, when found advisable, due to significantly changed physical or economic conditions, and to report thereon to Congress with recommendations on the advisability of modifying the structures of their operation, and for improving the quality of the environment in the overall public interest."

4. SCOPE OF STUDY

This is a report of survey scope. It deals with project planning, and information from compiled technical data and is discussed only so far as it affects the overall operational efficiency of the project.

All studies for this project were coordinated with the appropriate Federal, State or local agencies as well as other concerned individuals. A consulting engineerimg firm, Fay, Spofford and Thorndike of Boston, Massachusetts, performed a structural analysis of the concrete structures at the project. This analysis was done under contract by direction of the Corps of Engineers.

5. THE REPORT

Results of studies on this project are presented in two major parts; the main report and the appendix.

The main report is a nontechnical presentation of problems and solutions, plus an areal overview of the project, with tables and plates.

The appendix contains letters of comment from concerned Federal, State, and local organizations, as well as individuals.

Technical backup for this nontechnical report is on file at the New England Division, Waltham, Massachusetts, and is available upon request.

6. PRIOR STUDIES AND REPORTS

Several ongoing and completed reports exist for the Edward MacDowell Project Area and the Merrimack River Basin in general. They include:

a. "308" Report - A report dated 1 December 1930 and printed as House Document No. 649, 71st Congress, 3rd Session, found that navigation, flood control, power development, and irrigation improvements in the basin were not warranted at that time.

b. 1938 Report - A report dated 18 May 1938 and printed as House Document No. 689, 75th Congress, 3rd Session, presented a comprehensive plan for flood control in the basin. A plan, consisting of four reservoirs, all located in New Hampshire, and related flood control works, was recommended for development. The plan was authorized in compliance with Public Law No. 738, 74th Congress, as amended by Public Law No. 761, 75th Congress.

c. Survey Report of April 1940 - A report on navigation, flood control and water power recommended the addition of West Peterborough (MacDowell) Reservoir to the authorized flood control system. The project was subsequently approved by the Office of the Chief of Engineers as part of the comprehensive flood control plan for the Merrimack River Basin authorized by the Flood Control Acts of 1936 and 1938. The report also concluded that "Additional flood control on the Pemigewasset River can be obtained most economically through a multiple-purpose development at Livermore Falls in conjunction with Franklin Falls Reservoir." This report was not submitted to Congress.

d. Report to the States - This report dated March 1947 and entitled "Comprehensive Plan for Flood Control," was prepared to give the concerned states advance information on the plan for flood control in the Merrimack River Basin. The report proposed seven reservoirs for flood control, of which three included power storage with provisions for future addition of generating facilities.

e. NENYIAC Report - Flood control and allied water uses in the Merrimack River Basin are considered in Part 2, Chapter XV, "Merrimack River Basin," of The Resources of the New England-New York Region, a comprehensive survey of the land, water, and related resources of the New York-New England region. Prepared by the New England-New York Inter-Agency Committee, the report was referred in 1955 to the Governors and agencies concerned for comment, and submitted to the President of the United States by the Secretary of the Army on 27 April 1958. Part I and Chapter I of Part 2 are printed as Senate Document No. 14, 85th Congress, 1st Session.

f. "205" Report - A report on flood control and allied purposes in New England River Basins dated 30 June 1955, found that the flood problem in the Merrimack River Basin warranted construction of two reservoirs in addition to the three that had been completed. It stated that the proposed Hopkinton-Everett Lakes Project (completed in 1962) was adequately justified, but the construction of the other proposed projects, namely Livermore Falls Reservoir "would have adverse effects upon the economy of the area and is not recommended at this time." This report was completed subsequent to the initial printing of NENYIAC (see above), but prior to the printing of part of that report as a Senate Document.

g. The Merrimack River Basin Report, which was completed in August 1972, is a comprehensive water resources investigation of the entire basin. This report determines the advisability and economic feasibility of flood protection, navigation, and other water resources development in the remainder of the basin, and makes specific recommendations for programs and measures needed for the basin.

h. Project Data for Periodic Inspection, of MacDowell Dam. Completed in August 1973 by NED. The project was visited by a team of NED inspectors on 24 May 1967. The rock slope protection and concrete structures appeared to be in satisfactory operating conditions and no remedial repairs were indicated to be required at that time.

i. Real Estate Design Memorandum - Completed in April 1974, by NED. Recommended purchase of 115 acres of flowage easements downstream of MacDowell spillway, at a cost of $94,000.

j. Flood Plain Information - Contoocook River and Nubanusit Brook, Peterborough, N.H. Prepared by NED in April 1974. Includes history of flooding and delineates Intermediate and Standard Project Flood limits along the waterway.

k. Environmental Report - Operation, Maintenance and Management of Edward MacDowell Lake, January 1975. Prepared for NED by Curran Associates, Inc., Northampton, Massachusetts.

7. STUDIES IN PROGRESS

There are several important on-going studies which focus upon the natural resources of the Merrimack River Basin. These are the North Atlantic Regional Water Resources Study; the Northeastern United States Water Supply Study; and a pilot Wastewater Management Program Study. These studies are described below.

a. North Atlantic Regional Water Resources. The NAR Study is one of 20 regional framework comprehensive water and related land resources studies being conducted throughout the United States under guidelines established by the Water Resources Council. The NAR Study was authorized by the 1965 Flood Control Act (Section 208, Public Law 89-298). The study objective is the establishment of a broad master plan of framework to serve as a basis for future regional water resources development and management. The requirements and needs of the people of the region were considered in analyzing water resource needs including water quality control, flood control, municipal and industrial water supply, irrigation and rural water supply, navigation, hydroelectric power, recreation, fish and wildlife and other environmental resources. These needs are projected through the year 2020. The study began in 1966 and was completed in June 1972.

b. Northeastern United States Water Supply Study. The unprecedented drought that started in 1960 over the northeastern seaboard of the nation, led Congress to authorize the Secretary of the Army, in October 1965, to cooperate with Federal, State, and local agencies in preparing plans to meet the long-range water needs of the Northeastern United States. It anticipated that such plans may include major reservoirs, major conveyance facilities to transfer water between river basins, and major purification facilities to be constructed under Federal auspices with appropriate non-Federal financial participation. The NEWS Study was initiated in 1966 and is scheduled for completion in 1975.

c. Wastewater Management Program Study. In November 1974, the Corps of Engineers, NED, completed a survey scope type study for Waste Water Management of the Merrimack River. It presents a visionary and broad comprehensive program of waste water management which considers all alternative measures for the control of pollution, as well as

the feasibility of recycling wastes and storm water runoff. The study has been sent to state authorities for review. Any future phases of this program, if undertaken, will be accomplished by the Environmental Protection Agency and the Commonwealth of Massachusetts.

B. THE SETTING AND RESOURCES OF THE AREA

8. PROJECT DESCRIPTION

Edward MacDowell Lake is located on Nubanusit Brook, a tributary of the Contoocook River, in the Merrimack River Basin. It is located one half mile upstream from the village of West Peterborough, New Hampshire and 14 miles east of Keene, New Hampshire. The dam, completed in March 1950, is a rolled earthfill dam, with a dumped rock blanket. It is 67 feet high and 1030 feet long. The project cost $2,014,000 to complete; it is operated as part of a system in conjunction with three other flood control reservoirs in the Merrimack River Basin. These are Hopkinton-Everett Lakes on the Contoocook and Piscataquog Rivers, Blackwater Dam on the Blackwater River and Franklin Falls Dam on the Pemigewasset River. See PLATE I.

The Reservoir has a storage capacity of 12,800 acre-feet. This is equivalent to 5.5 inches of runoff from a drainage area of 43.7 square miles. A permanent pool at elevation 911+ is controlled by the flood control gates in the outlet works, located near the west side of the dam. These gates are operated during times of peak river flow to store floodwater. When full, an 840-acre reservoir would extend about three miles upstream.

A concrete spillway, consisting of a low weir 100 feet wide, is located in a natural saddle on the northeasterly side of the reservoir. The spillway crest is at elevation 946.0, and is over three miles from the dam site. Discharge from the spillway enters Davis Brook, then into Ferguson Brook, and then into the Contoocook River. See PLATE II.

There have been 31 significant operations of storage; the largest in terms of storage utilized being that of January 1956 when the reservoir was 58% full. In the event of a recurrence of the 1936 basin flood of record, the project would prevent an estimated $6.2 million dollars in damages.

9. WATERSHED DESCRIPTION

Edward MacDowell watershed is an elongated area with a maximum length of 11 miles, and a width of 5 miles. The total drainage area is almost 44 square miles. While portions of the watershed are fairly steep and conducive to rapid runoff, there is considerable storage in the watershed, both natural and man-made. The area is drained by two major tributaries: Nubanusit Brook, which rises in the north and flows southeasterly into MacDowell Reservoir; and Stanley Brook, which originates in the south and flows northeasterly. See PLATE II.

Several large lakes, which store flood surcharges and significantly reduce flood flows, are located on each tributary. The most effective on Nubanusit Brook are Nubanusit Lake, Harrisville Pond, and Skatutakee Lake. Those on Stanley Brook are Thorndike and Mud Ponds. A large swampy storage and retardation area also exists just upstream of Mud Pond.

10. REGIONAL INFORMATION

The Edward MacDowell Reservoir is located primarily within the two townships of Peterborough and Hancock, with a small portion also in Harrisville and Dublin, New Hampshire. Peterborough and Hancock are considered rural areas, having populations of 3200 and 1500 respectively. The countryside is either forested hills or rolling pastures, except for the village centers.

The climate of the area is variable with an average annual temperature of approximately 45°F. The average monthly temperature varies from 70 degrees in July to about 20 degrees in January. The average annual precipitation is about 44 inches with annual snowfall amounting to 70 inches. Average water content of the snow cover amounts to more than eight inches and spring melting generally occurs in late March and April. The growing season averages 160 days per year.

The area was basically industrial in the middle to late 19th century, owing to readily available water power. Due to past floods and fires and changes in labor markets, the local economy now operates around tourism and recreation. The project is located approximately at the crossroads of two major state highways, 101 and 137. Because of the area's rustic countryside, it is now a haven for artists, photographers and retirees.

The labor force is comprised of three major categories. Over a third occupy professional or technical positions. Another third are employed in manufacturing mostly durable goods. The remaining portion of the labor force is involved with service type jobs, farming being virtually nonexistent. It is important to note that most of the people involved in manufacturing commute, as only a few small industries still exist in the project area.

People in the project area enjoy an above average standard of living. Less than two percent of the work force (male and female, 16 years old and over) are unemployed and only 5.5% earn less than government set poverty level income. The average number of years of school attended is 12.9, with over a third having completed 4 or more years of college.*

The area is very attractive to the well-to-do income bracket and artists. New Hampshire's low state taxes attract many second home people who earn their income outside the state, especially in Massachusetts. The Edward MacDowell Artist Colony attracts many artists from all disciplines on a live-in apprenticeship basis.

11. COORDINATION

The problems and needs became apparent during the process of data collection and reanalysis of the project, or were pointed out by concerned agencies, groups, or individuals.

Due to revised design criteria, an investigation was made of the concrete structures at the dam and spillway. It was found that under unusual loading conditions, some of the walls and spillways do not meet the up-dated design requirements.

Letters requesting comments on other problems or needs were sent to all concerned groups and agencies on Federal, State and local levels. The Federal agencies which responded are:

National Park Service
Bureau of Sport Fisheries
Fish & Wildlife Service
Bureau of Outdoor Recreation
Dept. of Housing & Urban Development
Environmental Protection Agency
Soil Conservation Service

* All data from 1970 U.S. Census Bureau Report

The Bureau of Fish & Wildlife noted that consideration should be given to selective timber harvesting and clearing operations. This would provide habitat for a greater variety of wildlife. An overall management plan including creation of new marshes for wildfowl, and enhancement of streams for sport fishing as well as timber clearing and harvesting would enhance all wildlife habitat.

The Department of Housing & Urban Development stated that in February 1974, an upper income apartment development was being contemplated in West Peterborough on the Nubanusit Brook, approximately 1/4 mile downstream of MacDowell Dam and they were concerned about flood elevations. The HUD committment expired on 10 May 1975 and the development was never started.

Non-Federal agencies who responded are:

State of New Hampshire
New England River Basins Commission
Merrimack River Valley Flood Control Commission
Town of Peterborough

Copies of the pertinent correspondence received are in APPENDIX A. The following is a summary of those letters which expressed specific comments or desires:

The New Hampshire State Water Supply and Pollution Control Commission felt that low-flow augmentation for water quality was not needed.

The New Hampshire Fish & Game Department (NHF&G) is considering the creation of wild fowl habitat within the project area just upstream of the old Swetts Dam location. They are also interested in non-structural measures which will insure present channel capacity, but not channelization. Plans have been shelved indefinitely as the State of New Hampshire has no funds available at this time for participation in such an undertaking.

Government organizations and private citizens have expressed a desire for non-structural flood control measures, such as local flood plain zoning. At the request of the Town of Peterborough, and with the endorsement of the State of New Hampshire Water Resources Board, a Flood Plain Information Report for Peterborough was prepared by NED in April 1974, under continuing authority provided in Section 206 of the 1960 Flood Control Act, as amended. A HUD Flood Insurance community study is scheduled for the future.

C. INVESTIGATIONS

12. GENERAL

Investigations were made in the areas of: hydrology and flood regulation, water quality, real estate, environmental impact, foundation and materials, and structural analysis. These reports discuss general operation of the project and any problems which may have become apparent through the investigations.

13. HYDROLOGY

When Edward MacDowell Lake was designed in 1945, no long-term record of streamflow on Nubanusit Brook was available. However, using highwater data for the floods of record, peak discharges were determined at Verney Mills Dam, located 1,000 feet downstream of MacDowell Lake. Peak discharges of 4140 c.f.s. and 4100 c.f.s. were calculated for the floods of March 1936 and September 1938, respectively.

To compute the size and configuration of the spillway during design, a Spillway Design Flood (SDF) was generated. A SDF is defined as representing the critical volume and concentration of flood runoff into the reservoir under the most extreme conditions considered reasonable. TABLE A shows the pertinent data for the project.

In order to determine what flowage easements were necessary downstream of the spillway, the Standard Project Flood (SPF) and unit hydrograph was developed. It was done in conjunction with a hydraulic analysis of Davis and Ferguson Brooks downstream of the spillway for MacDowell Lake Project. The SPF, with peak of 15,000 c.f.s. (345 c.s.m.) would completely fill the reservoir and produce a peak spillway discharge of 2800 c.f.s.

The spillway at MacDowell is unique in New England, in that it is not located at the main dam. It is located about 3 miles upstream on the watershed divide. Consequently, when spillage occurs, flows are diverted from the Nubanusit Brook watershed to Davis Brook in the Ferguson Brook watershed. The original intention of locating the spillway upstream of the dam was to discharge into Ferguson Brook, and in turn, into Bennington Reservoir. However, the Bennington project was superseded by the Hopkinton-Everett Reservoir complex located further downstream on the Contoocook River.

TABLE A

PERTINENT DATA

Item	Original Design Criteria	1973 Criteria
SPILLWAY DESIGN STORM		
Basis of Design	R&H No. 9 (1)	HR No. 33 (2)
Volume of Rain (in 24 hrs.)	19.9	20.5
Losses (in 24 hrs.)	1.0	1.6
UNIT HYDROGRAPH		
Unit Rainfall Duration (hrs.)	3	3
Peak Flows (cfs)	2,240	*
SPILLWAY DESIGN FLOOD		
Peak Inflow (cfs)	36,300	30,100
Peak Outflow (cfs)	17,800	16,600
SDF RESERVOIR REGULATION PLAN		
Initial Pool Elev. (ft. msl)	946.0	946.0
Outlet Facil, During Floods	Closed	Operable
Max, Stage at Spillway (ft. msl)	958.2	958.2
Losses thru Approach Chn (ft.)	2.6	2.0
Max. Stage, Halfmoon Pd (ft. msl)	960.8	960.2
Allowances for Breach of Upstream Dam (ft.)	1.0	1.0
Other Losses	0.0	0.8
Freeboard	5.0	3.0
Design Height of Dam	967.0 (built)	965.0

1. Rivers and Harbors Eng. Bulletin
2. Hydrometeological Report

* Total drainage area broken down into 4 sub-watersheds

As a result of this investigation, it is considered that there is no need for changes to the spillway length or height of dam due to hydrologic design conditions, and that the present real estate holdings in the MacDowell Reservoir area to elevation 949 feet msl. or 3 feet above spillway crest, are adequate. PLATE III shows the limits of the Government owned land.

14. WATER QUALITY

The Edward MacDowell Dam controls 44 square miles of the Nubanusit Brook, a tributary to the Contoocook River which is a major tributary to the Merrimack River Basin. During normal flow periods the dam impounds a 163-acre conservation pool at elevation 911 feet, mean sea level, which is primarily used as forage area by waterfowl. The pool has a maximum depth of about 7 feet and a mean depth of approximately 1 foot. It has a maximum length of about 8,660 feet and a mean width of approximately 820 feet.

Until recently, a small reach of Nubanusit Brook in Harrisville, New Hampshire was Class D water quality, while another downstream portion extending to the head of Lake Skatutakee was classified as Class C. These reaches, both upstream of the dam, were redesignated as Class B in 1973, after the textile mill causing the water quality degradation closed.

Class B waters have no objectionable physical characteristics. These waters are considered as being acceptable for bathing and other recreational purposes. They can be used as a water supply source after adequate treatment. There can be no disposal of sewage or waste into Class B water except those which have received adequate treatment to prevent the lowering of the physical, chemical and bacteriological characteristics of the water. The water must be near saturation for dissolved oxygen (not less than 75%) and it must not contain more than 240 coliform bacteria per 100 milliliters.

Periodic water quality monitoring between February and September 1974 by the New England Division's water quality laboratory has indicated that all of the dissolved oxygen concentration values in Nubanusit Brook upstream of the conservation pool were between 72 and 120 percent saturation. However, other parameters measured in the inflow waters indicate that the waters entering the conservation pool do not meet the Class B standards. A total coliform bacteria value of greater than 1,600 colonies per 100 ml. was measured in June and a value of 700 was measured in July. Hydrogen ion concentration (pH) as low as 5.3 units were measured. Also, traces of zinc, iron and copper have been reported.

Stanley Brook, a minor tributary to the conservation pool has had variable water quality since 1971. At that time the dissolved oxygen concentration values reached as low as 35 percent of saturation. In 1974, the summer values indicated 41 percent to 96 percent saturation. The pH values in the brook have dropped to as low as 5.1 units. The total coliform bacteria concentrations measured during the summer of 1974 ranged from approximately 240 to 500 colonies per 100 ml. The presence of zinc and iron has also been detected.

The quality of the water discharged from the conservation pool does not currently meet the New Hampshire standards for Class B, although most of the summer water samples of 1974 have been between 90 to 101 percent saturation. Furthermore, total coliform bacteria were measured at concentrations of 2,800 and 2,400 colonies per 100 milliliters on two occasions in 1974. In August 1974, the fecal coliform bacteria were measured at 1,400 colonies per 100 milliliters. Iron and zinc were also detected in slight amounts.

The presence of these pollutants is not caused by or increased by the existence or operation of the Edward MacDowell project. It is believed they are from natural swampy and waterfowl areas along the upstream stem and tributaries of Nubanusit Brook.

15. OPERATIONS AND FLOOD REGULATION

Reservoir regulation functions of the New England Division are performed by the Reservoir Control Center (RCC), which is part of the Water Control Branch of the Engineering Division.

During normal (nonflood) summer periods, the gates are operated to maintain the conservation pool between 910 and 911 feet, m.s.l. To prevent their freezing during the winter months, the gates are operated by the Project Manager to maintain the pool between elevation 911 and 912 m.s.l.

During flood periods, MacDowell Dam and Reservoir is operated for the protection of West Peterborough and Peterborough from localized flooding on Nubanusit Brook and the Contoocook River. By restricting flows on Nubanusit Brook, the project helps to provide protection to the communities of Bennington, Hillsboro and Henniker further downstream on the Contoocook. In addition, it provides some reduction to the inflows at Hopkinton Lake.

The Project Manager immediately notifies RCC by radio or telephone if any of the following conditions occur:

(1) One inch of precipitation during any 24-hour period.

(2) A rising pool stage of 913 feet, msl, or an outflow exceeding 250 cfs.

(3) A rising stage of 3.5 feet (640 cfs) at the gaging station on the Contoocook River upstream of Peterborough.

(4) A rising stage of 3.3 feet (1,100 cfs) at the staff gage on the Contoocook River in the center of Peterborough.

There have been 31 significant storage operations since the project became operational in 1950. Thirteen of these occurred during the month of April, and an additional 11 operations were during the months of January, February and March. The major impoundments are shown in TABLE B.

TABLE B

MAJOR IMPOUNDMENTS

Year	Date	Maximum W.S. Elev. ft. m.s.l.	Storage Acre ft.	Use: % of Total
1951	April	934.0	6,700	52
1956	Jan.	935.6	7,400	58
1958	April	931.2	5,750	43
1960	April	934.8	7,050	55

During these impoundments the project has operated in a satisfactory manner and without problems.

During flood periods, regulation occurs in three phases:

(1) Initial Regulation of Flow: Complete closure of the gates are made whenever flood stages are expected to be exceeded at downstream index stations on the Contoocook or Merrimack Rivers. Partial closure of gates are made for minor or slow rising floods. The reservoir discharge will be restricted in accordance with stages on the Contoocook River.

(2) Continuation of Regulation: Regulation of the reservoir will normally continue as described above until the flow has crested and begins to recede at downstream index stations on the Contoocook and Merrimack Rivers. However, during severe flood conditions, when a major portion of the flood storage has been utilized, it may be desirable to initiate discharge from MacDowell Reservoir prior to recession of Merrimack River flows below non-damaging discharges. Releases will be in accordance with established guidelines.

(3) Emptying the Reservoir: Following the recession of the flood, the reservoir will be emptied as rapidly as possible without exceeding established channel capacities (650 cfs on Nubanusit Brook, 1,850 cfs on the Contoocook River in the center of Peterborough). The rate of increase in the reservoir discharge during emptying shall not exceed about 100 cfs per hour.

The above regulating procedures have proven to be satisfactory since completion of the project, and no changes are contemplated in the near future.

16. REAL ESTATE

At 33 of 35 NED flood dams, uncontrolled spillway discharge is passed immediately back into the river channel downstream of the dams. However, at the MacDowell Lake Project, flood flows are diverted from the Nubanusit Brook watershed. Spillway discharges circumvent Peterborough center by diverting into Davis Brook, then into Ferguson Brook, and finally into the Contoocook River, approximately 6 miles downstream of Peterborough.

Early in the study it was found that the project was deficient in flowage easements downstream of the spillway, and steps were taken to remedy the situation as soon as possible. The original plan was to have the spillway discharge flow into the then proposed Bennington Reservoir. The Bennington Dam Project was to back water up Ferguson Brook to a small private dam, Daloz Dam, near the Peterborough-Hancock Town Line. At the time of construction, it was considered necessary to obtain easements only along the MacDowell spillway chute. This easement is approximately 250 feet wide for a distance of 4500 feet downstream of spillway crest. There is no surplus of property for project needs.

Hydrologic problems necessitated the Hopkinton-Everett Dam Complex, which was constructed in 1962. This deactivated the previous upstream proposal of the Bennington Reservoir. Consequently, easements which were to have been acquired for the MacDowell floodway were not obtained.

Approach Channel and Spillway - Aerial view looking downstream from Halfmoon Pond.

A hydraulic analysis was made of Davis and Ferguson Brooks downstream of the spillway. The purpose was to determine what the hydraulically desirable limits of flowage easements are and what additional easements should be acquired. A computer program was used to analyze the effects of flood flows associated with a SPF. Data was taken from topographic maps and field survey. Further, coincident flood stages on the Contoocook River were assumed the same as those of September 1936, the flood of record.

A real estate memorandum was published on the acquisition of an additional 115 acres of flowage easements in April 1974. The Office of the Chief of Engineers approved the memorandum and authorized the acquisition in September 1974. The actual acreage was 131 acres and purchase of the easements and raising 350 lineal feet of Link Road was completed in July 1975, using operatious and maintenance funds of $66,000. PLATE IV shows the easement delineations.

There was no displacement of any individual businesses or farm land which required payment under Public Law 91-646, Uniform Relocation and Real Property Acquisition Act of 1970.

17. FOUNDATIONS AND MATERIALS

The embankment stability studies for the design of the Edward MacDowell Lake were reviewed in light of current practice and criteria. This review covered the selection of design shear strength parameters, methods of stability analysis and the performance record of the embankment. The design shear strength parameters were developed from the results of laboratory shear tests. Procedures for the development of these design parameters, however, have changed significantly since the time of completion (1950) and, for purposes of this review, new parameters were derived from the original test results by current methods.

The methods of embankment stability analysis used in designing the dam embankment are among those prescribed in Engineer Manual EM 1110-2-1902 Stability of Earth and Rock-Fill Dams. The cases analyzed, however, did not include all of those currently considered. The embankment, therefore, was re-analyzed, using the new shear strength parameters, for the following cases: sudden drawdown, steady seepage, and partial pool. The results of these re-analyses indicate that the dam embankment satisfied current criteria for stability against shear failure.

The dam embankment has been in place for almost 25 years. During this time, there have been numerous cycles of reservoir filling and drawdown. The embankment shows no evidence of unsatisfactory performance with respect to possible embankment or foundation shear failure. As a result of this review, the following conclusions are drawn:

- Although procedures for the selection of design shear strength parameters have changed significantly since the design of this embankment, satisfactory factors of safety were obtained using new parameters in the stability analyses done for this review.

- Except for the fact that a limited number of locations were reviewed, the embankment stability analyses for the design of this dam were conducted in accordance with current procedures.

- The results of this review indicate that the stability of the dam embankment against shear failure satisfies current criteria.

Seepage Control

The seepage control studies have been reviewed in the light of current practice and criteria. This review covered flow-net analysis, the development of filter gradation specifications, the design of the seepage control features and the performance record of the dam embankment . The seepage control design procedures and criteria used in the original design are essentially the same as those in current use and current seepage control embankment has never shown evidence of unsatisfactory performance with respect to seepage.

18. ENVIRONMENTAL EVALUATION

Environmental Setting - The project area lies in the path of prevailing westerlies, but is also exposed to Atlantic coastal storms, locally known as "nor'easters." Storms of tropical origin, sometimes of hurricane intensity and associated with extremely heavy rainfall, have infrequently occurred in the region during the late summer and early autumn. The Nubanusit Brook Basin drains southeastward from its headwaters at Nubanusit Lake, seven miles northwest of MacDowell Dam into the Contoocook River at Peterborough. The drainage divide, straddled by Mount Monadnock at elevation 3,965 feet m.s.l. forms the eastern perimeter. The elevation at the confluence of Nubanusit Brook and the Contoocook River is approximately 740 feet m.s.l. The region between these extremes of elevation is characterized by rather broad, often marsh-covered, upland valleys bounded by hills and ridges with moderately steep slopes. The Nubanusit Brook Basin is mostly wooded. An absence

of trees is noticeable only around areas of open water and marsh. The forest cover is dominated by northern hard woods and other species, interspersed with stands of white pine and hemlock. Marsh areas support various associations of grasses, ferns and shrubs. Small farms dot the area but, in aggregate, the cultivated acreage is a very small percentage of the drainage area.

Various kinds of wildlife indigenous to southern New Hampshire can be found in the area, including migrating waterfowl. The shallow pools and ponds provide good fisheries for horned pout, pickeral, perch, bass and trout. The project area is managed by the New Hampshire Fish and Game Department, under a 25-year lease with the Corps of Engineers.

The water sources within the project area serve principally to support fisheries and wildlife habitat. However, at Halfmoon Pond and Boston Univeristy's Sargent Camp, year-round recreational and educational programs are conducted, some of which utilize that body of water for swimming and other purposes.

Environmental Investigation - An environmental evaluation has been made of the project area. Information on all aspects of the project were investigated by Corps of Engineers environmental personnel, and other Federal and State agencies.

No historic or archeological features are known to exist within the area of the project which may be flooded by the waters impounded by the dam.

Public recreational use of the project lands is that which principally involves the activities of fishermen and hunters. Fishermen mostly seek the warm water species of fish to be found in the four permanent ponds within the project's boundaries. An informal boat launch for rowboats and other craft without motors has been established for the public on the east side of the conservation pool; other make-shift launch sites also exist. Waterfowl hunters also frequent the area during the migratory bird season. Periodic storage operations at the dam have temporarily impeded access for fishermen, hunters and trappers, but the inconvenience to users is not serious. Impact of such inundation upon the fisheries and sports such as snowmobiling, snowshoeing and cross-country skiing are rarely affected by project operations.

Picnicking facilities are provided by the Corps at two sites, one just north of the dam on the west side of the permanent pool (11 tables and eight fireplaces) and another downstream from the dam (five tables and two fireplaces). Neither site is within the flood pool area; therefore, changes in water level have no impact upon the public's use of these facilities.

There has been minimal commitment of the project's resources to improve recreational uses, and the options for future development of some specific, mostly water-related recreational benefits remain. However, existing uses of the project's land and water resources for hunting, fishing, snowmobiling, boating, hiking and other pursuits are perhaps best served by the absence of developed recreational facilities. Therefore, deferral of a commitment to provide for increased picnicking and other concentrated recreational land uses should continue until periodic review justify policy changes which, in time, support development of facilities for more intensive uses of the project.

The concensus of letters received from Federal, State, municipal and conservation agencies is that the Edward MacDowell Lake Project for flood control, conservation, wildlife, and wildlife management be continued under the present methods of operation, and that there is no need for low flow augmentation for water quality or for structural modifications to develop an additional water supply. There is, however, an interest to adopt an overall management plan for timber harvesting, small game improvement, fish and wildlife enhancement, and other related uses. Continuing present operations management and developing fish and wildlife enhancement, will have no apparent adverse environmental effect on the existing project.

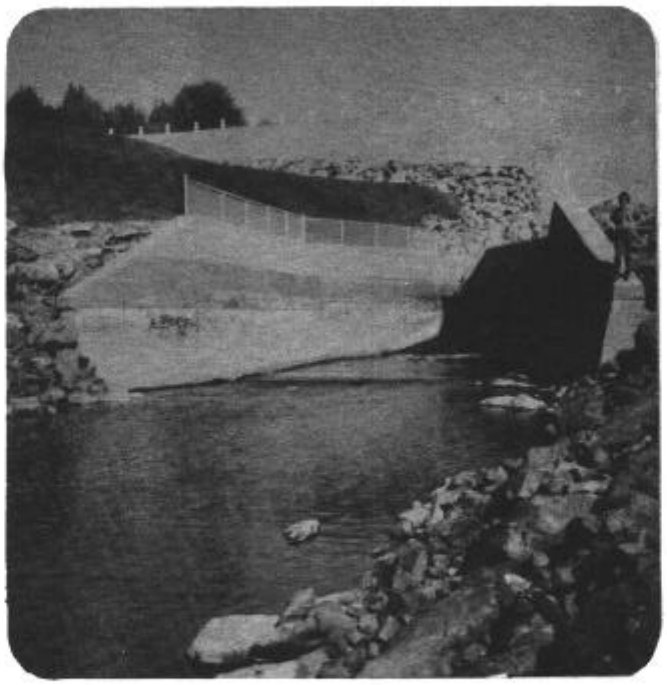
19. STRUCTURAL ANALYSIS

A detailed structural analysis has been made of the concrete structures at Edward MacDowell Lake, including the intake structure, stilling basin retaining walls, service bridge and abutment, spillway and spillway walls. All structures were analyzed under present Corps design criteria by the engineering consultant, Fay, Spofford, & Thorndike under contract to and supervision of the Corps of Engineers, NED.

The intake structure, service bridge pier and abutment, in all cases, satisfy the requirements of the new criteria for stability and no modifications or strengthening is required.

The remaining structures investigated satisfy tnis criteria, except for Loading Cases II and III, which are partial sudden drawdown and sudden rise in the reservoir, respectively. Under design maximum flood conditions, the resultant falls outside of the middle third in the majority of the sections investigated, but still within the base.

The estimated cost in July 1974, for the recommended remedial measures, consisting of tie rod anchorage or rock anchors, for these structures are as follows:



Stilling Basin and Outlet Structure.- Retaining walls do not meet present day design criteria under adverse loading conditions.

Spillway and Spillway walls - This structure also does not meet design criteria under certain loading conditions.

Spillway: Rock anchors at 8 feet 0 inch on center along crest. - $16,000

Spillway Walls: Tie rod anchorage, 170 feet of wall. - $31,000

Stilling Basin Retaining Walls: Tie rod anchorage, 200 feet of wall. - $30,000

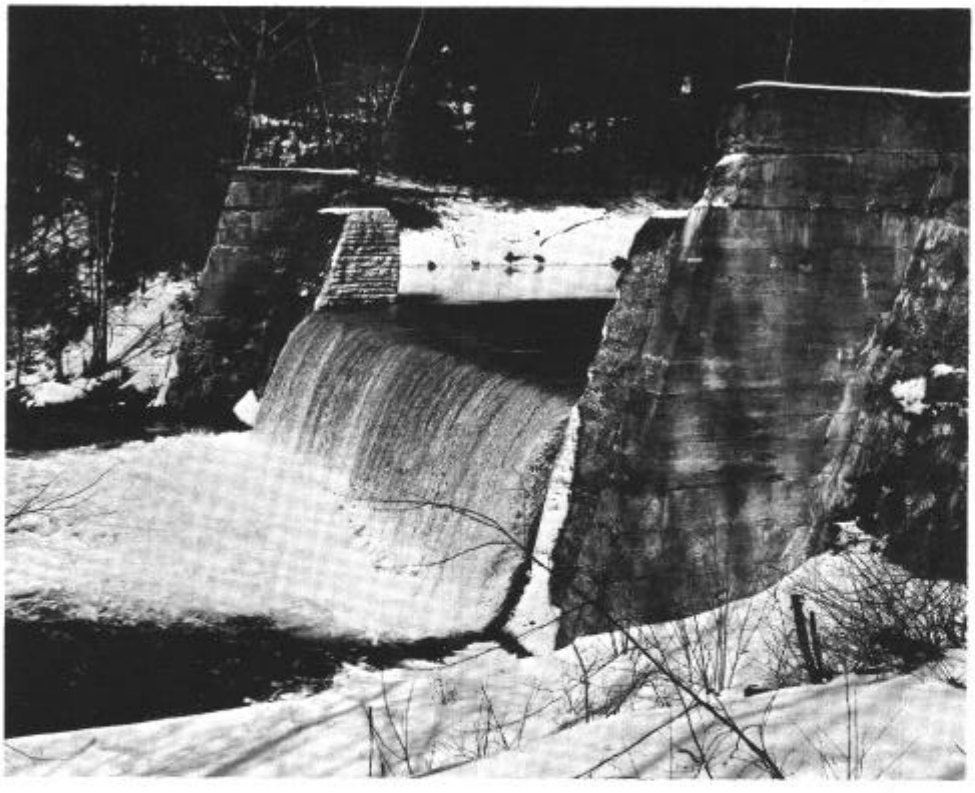
TOTAL $ 77,000

The proposed remedial measures will be given further consideration under the Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures as directed by ER 1110-2-100, which directs that Civil Works structures whose failure or partial failure would endanger the lives of the public or cause substantial property damage will be continuously evaluated to insure their structural safety and stability, and operational adequacy. Such evaluations will be conducted to detect conditions of significant structural distress or operational inadequacy and to provide a basis for timely initiation of restorative and remedial measures.

Verney Mills Dam - Prior to construction of the Edward MacDowell Lake Project, the Verney Mills Dam, located about 1,000 feet downstream, was privately owned and allowed to remain in place. There was a deep pool between the two dams and a shallow pond upstream of Edward MacDowell Dam. Both pools were at the same level.

The pool between the two dams was an aesthetic attraction in which trout were stocked by the State of New Hampshire. In 1972 engineers of the New Hampshire Water Resources Board inspected the dam, found conditions of severe erosion on the concrete structure and ordered the owner to make repairs. The owner negotiated with the Corps of Engineers and in April 1973 the Corps acquired the property. Following a thorough investigation of the foundation conditions by borings and a structural design analysis the Corps concluded that Verney Mills Dam was unsafe and must either be repaired or removed. The cost of repair, estimated to be at least $150,000 was considered to be excessive. It was decided, for safety reasons, to remove a portion of the spillway 62 feet long by 10 feet deep and permit the remainder of the structure to retain the pool at the lower elevation. This alteration was completed on 20 March 1974 and the new pool is presently in operation. The total project cost of the alteration was $14,600.

Verney Mills Dam - View looking downstream from MacDowell Dam. Previously a privately owned dam, now within project limits.



Verney Mills Dam - For safety considerations, dam has been breached and no longer controls pool elevation behind MacDowell Dam.

D. SUMMARY

20. SUMMARY

The Edward MacDowell Lake Project is located on the Nubanusit River in the Merrimack River Basin. An earthfilled dam 1,030 feet long with a dumped rock blanket, is located one-half mile upstream from the village of West Peterborough, New Hampshire. The spillway is located over three miles upstream of the dam and discharges into the adjacent Davis and Ferguson Brooks.

The project cost $2,014,000 to complete and became operational in 1950. The reservoir is operated as a part of a flood control system, in the Merrimack River Basin, in conjunction with the Hopkinton-Everett Lakes Project and the Blackwater and Franklin Falls Dams.

The water resources within the project area serve principally to support fisheries and wildlife habitat, and other related small scale recreational uses.

There have been 31 significant storage operations since the project became operational. About half occurred in the month of April. The largest, in terms of storage, occurred over 19 years ago in January 1956, when the reservoir was 58% full.

Two significant reports have been written during the course of this "216" investigation. The first was the Real Estate Design Memorandum on Flowage Easements and the other was Flood Plain Information for Peterborough, New Hampshire. Both were printed in April 1974.

E. CONCLUSIONS

21. CONCLUSIONS

The Division Engineer finds that:

- Minor structural modifications are required on the spillway, spillway walls, and stilling basin walls, due to up-dated design criteria.

- The present operations and flood regulation of the project are satisfactory.

- There are no real estate deficiencies. Recent acquisition of 131 acres of flowage easements, downstream of the spillway eliminated the previous deficiencies.

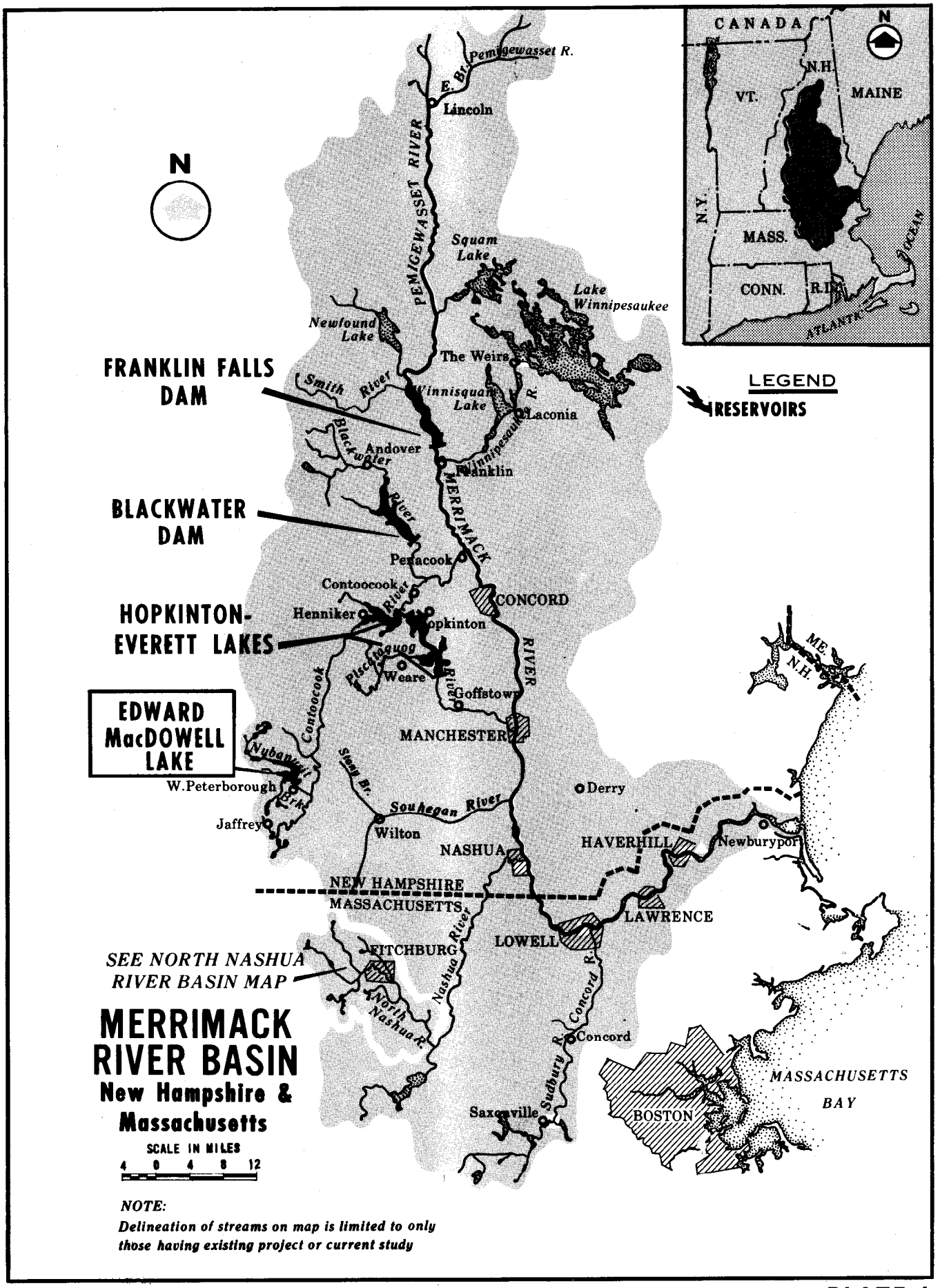
- There is no need for increased recreational facilities or change in the present method of operations of the existing flood control project, based upon correspondence received from Federal, State, Municipal and other interests.

F. RECOMMENDATIONS

22. RECOMMENDATIONS

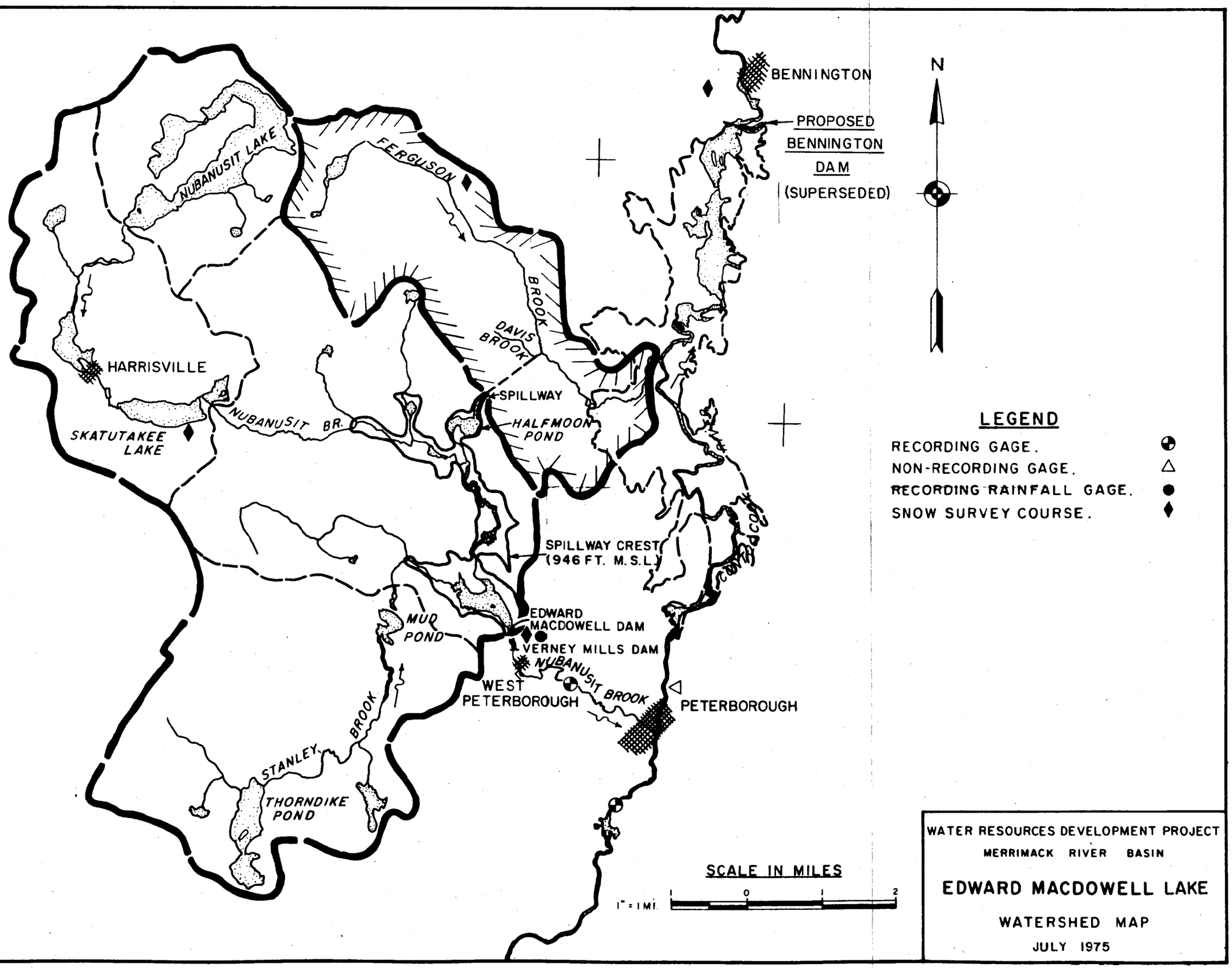
The Division Engineer recommends that no reformulation of the operations of the existing project be made at this time.

JOHN H. MASON
Colonel, Corps of Engineers
Division Engineer



NOTE:
Delineation of streams on map is limited to only those having existing project or current study

PLATE 1



WATER RESOURCES DEVELOPMENT PROJECT

MERRIMACK RIVER BASIN

EDWARD MACDOWELL LAKE

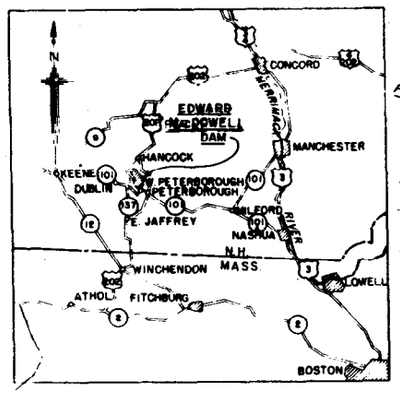
WATERSHED MAP

JULY 1975

PLATE II

CORPS OF ENGINEERS

U. S. ARMY



VICINITY MAP

SCALE IN MILES

10 0 10 20

Ferguson Brook

To Peterborough

℄ SPILLWAY CHANNEL

DIKE

SPILLWAY CREST EL. 946.0

LIMIT OF GOVERNMENT OWNED LAND

TOWN OF HANCOCK
TOWN OF PETERBOROUGH

To West Peterborough

HALFMOON POND

SARGENT SCHOOL CAMP

NEW HAMPSHIRE F & G PROPOSED SUB-IMPOUNDMENT

BROOK

SWETTS DAM

PERMANENT POOL

El 912±

WEST SIDE ROAD

CLUBBY SCOTT RD

WINDY ROW

FLOW LINE AT SPILLWAY CREST EL. 946.0

WEST PETERBOROUGH

HARRISVILLE ROAD

DAM
SPILLWAY CREST, EL. 946.0

VERNEY MILLS DAM
SPILLWAY CREST EL. 909.65

To Peterborough

To Dublin

HILLSBORO CO.
CHESHIRE CO.

TOWN OF PETERBOROUGH
TOWN OF DUBLIN

LIMIT OF GOVERNMENT OWNED LAND

TO HANCOCK

HILLSBORO CO.
CHESHIRE CO.

TOWN OF HANCOCK
TOWN OF HARRISVILLE

BEAVER POND

NUBANUSIT BROOK

HALFMOON POND

FLOW LINE AT SPILLWAY CREST EL. 946.0

LIMIT OF GOVERNMENT OWNED LAND

TOWN OF HARRISVILLE
TOWN OF DUBLIN

To Eastview

To E. Jaffrey

NOTES

Topography based on Aerial Photographic Surveys
Elevations refer to Mean Sea Level datum
Reservoir information reproduced from Dwg. No. M78-12/79.1 dated OCT. 1947

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY | DR. BY | CK. BY

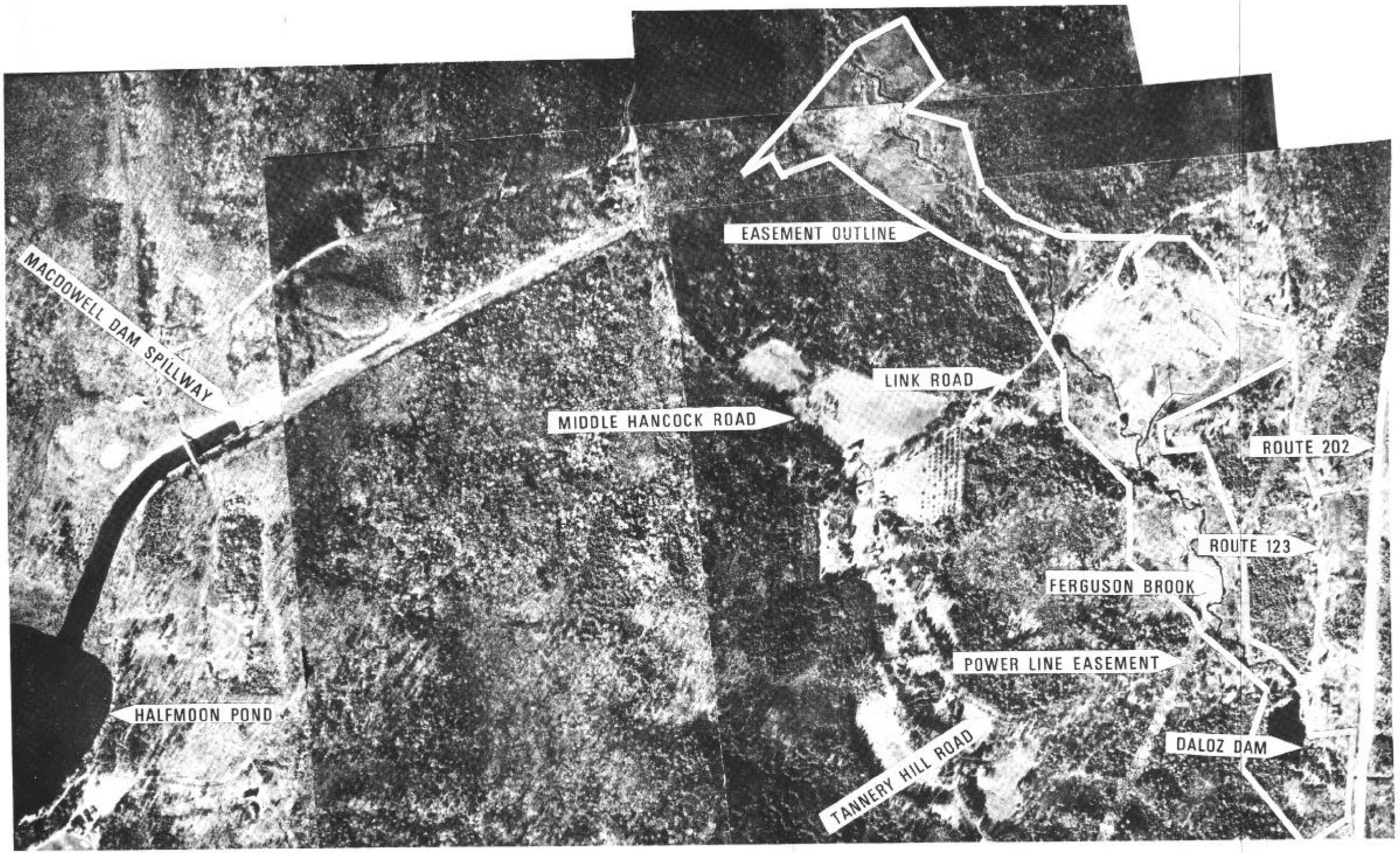
SUBMITTED
CHIEF, ENGINEERING SECTION
PROJECT ENGINEER
APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH
APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

MERRIMACK RIVER FLOOD CONTROL
EDWARD MacDOWELL LAKE
RESERVOIR MAP
NUBANUSIT BROOK, NEW HAMPSHIRE

APPROVED
CHIEF, ENGINEERING DIVISION
DATE

SCALE
SPEC. NO. CIV. ENG. 19-016-
DRAWING NUMBER

PLATE III



GRAPHIC SCALE

1"=800'

MERRIMAC RIVER BASIN

EDWARD MACDOWELL DAM

FLOWAGE EASEMENTS DOWNSTREAM OF SPILLWAY

AERIAL MOSAIC

FERGUSON BROOK NEW HAMPSHIRE

PLATE IV

LETTERS OF COMMENT

TABLE OF CONTENTS

The State of New Hampshire

Water Supply and Pollution Control Commission
Prescott Park
P.O. Box 95—105 Loudon Road
Concord 03301

January 21, 1974

John W. Leslie, Chief, Engineering Division
Department of the Army
New England Division, Coprs of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

Reference is made to your letter of January 4, 1974 relative to your review of the operation of the Edward MacDowell Dam.

We have no requirements for modifying the present structure or operation of the facility. Specifically there is no need for low flow augmentation in the upper Contoocook River basin to attain desired water quality in this region.

Sincerely yours,

William A. Healy, P.E.
Executive Director

WAH:WRF/lw

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Federal Building, Durham, New Hampshire 03824

January 23, 1974

Mr. John W. Leslie
Chief, Engineering Division
U.S. Army Corps of Engineers
424 Trapelo Road
Waltham, Mass. 02154

Dear John:

We have reviewed your letter of January 4, 1974, which sets forth some considerations for modifying the Edward MacDowell project located at Peterborough, New Hampshire.

At this time we do not have any comments to make. However, at some later date if more firm proposals are set forth we would be glad to review them.

Sincerely,

Charles H. Dwight acting

Donald G. Burbank
State Conservationist

OFFICE OF COMPREHENSIVE PLANNING
STATE OF NEW HAMPSHIRE
STATE HOUSE ANNEX, CONCORD 03301

TO: Irv Waitsman

SUBJECT: New Hampshire Guide Plan response to review of the Edward MacDowell Dam, Corps of Engineers Project in New Hampshire, for NERBC to forward to the Corps of Engineers (NEDED-R)

FROM: Tony Dater

DATE: January 24, 1974

A. The New Hampshire Guide Plan re: the operation of the Edward MacDowell Project

1. Soils - Other than the marshes in the area, the soils surrounding most of the Edward MacDowell reservoir could accomodate moderate, i.e. residential and community-type development. On the eastern side of Half Moon Pond and around the Ferguson Brook outlet, the soils have limited development capability, i.e. can accomodate rural housing, recreational, forestry, and some non-intensive agricultural uses. Some moderate (15%-25%) slopes present a limiting factor to developments in the Edward MacDowell Reservoir area.

Generally, the soils of the Contoocook Valley from Peterborough to Hillsborough on elevations above the floodplain can support intensive developments. The narrow valley with no floodplain through which the Contoocook River flows between the Hillsborough/Henniker township lines and West Henniker Village is characterized by limited development capable soils. The bottom land on elevations above the floodplain of the lower Contoocook River downstream from West Henniker is capable of accomodating moderate land-uses. On the north side of the river from West Hopkinton to Horse Hill, and on the south of the river from Rattlesnake Hill to the confluence with the Merrimack River at Penacook, the river bottom land is surrounded by intense development capable lands. The entire floodplain and bottom land between West Henniker and the Merrimack River confluence is suitable for agriculture. By maintaining this floodplain of the lower Contoocook River for agricultural, recreational, or natural uses, occassional flooding would not be harmful. It would, in fact, be beneficial to agriculture.

2. Mineral Resources - Below the Nubanusit spillway crest along Nubanusit Creek, and along the entire Contoocook River from south of Peterborough are sand and gravel deposits. About 12% of the Contoocook Basin upstream of Henniker is covered with sand and gravel, and about 23% of the basin between Henniker and Penacook is covered. Extensive sand and gravel extraction of the floodplain, without contoured reclaimation of the land, would destroy the suitable agricultural land of the lower Contoocook Basin, while disrupting the natural ground water regime of the upper basin. Extensive sand and gravel extraction can magnify stream oscillations downstream as well as contribute large amounts of sedimentation, potentially harmful to aquatic life and resulting in raising the stream bed in places, causing, in effect, a wider stream channel in that stream segment. On the other hand, during actual flood stage, floodplain sand and gravel extraction pits store between 70% to 75% more flood water than if the pits were not there. For water quality maintenance, the New Hampshire Guide Plan has recommended that sand and gravel mining be allowed on 10 year floodplains only if stream flow is not altered and sedimentation does not result. Also recommended is that no

mining be allowed on 100-year floodplains that disrupts the natural ground water storage capacity of the floodplain. This would mean, in practice, that mining could be done to the depth of the seasonally high water table level. All mined areas on floodplains are also recommended to be reclaimed and recontoured such that agricultural machinery could subsequently be used. Some of the authority to enforce these recommendations exists in present state laws. On agricultural land designated as "prime," i.e. soils that attain 60% or more of their total suitability for agriculture, the Guide Plan recommends that no mining be allowed at all. It is recommended that state law protect "prime" agricultural land by restricting these scattered floodplain areas to agricultural buildings and uses; and houses to less than one per 25 acres. The lower Contoocook valley rates 58% of agricultural suitability and is not "prime" agricultural soil, but is very suitable agricultural soil. The effect of these recommendations upon the operation of the Edward MacDowell Dam would be to reduce the hazard of pollution of the Contoocook River during both normal flow and flood stage flow. They would also tend to maintain more moderate stream flow flucuations than would be the case if unregulated streamside sand and gravel extraction were practiced. These would tend to place reliance of flow-maintenance on non-structural floodplain management, thereby reducing the need to alter the present operation of, or add new structures to, the Edward MacDowell Dam for low-flow augmentation.

3. Surface Water - The entire Contoocook River has substantial low-flow problems. During the period 1960-1969, the river flow was below the standard for fish habitat support flow, of .25 CFS per square mile of drainage area, about 15% of the time at Henniker, and 16% at Penacook. Fish habitat support flow at Henniker for the period 1960-1969 was about 16% of the mean Contoocook River flow, and at Penacook it was 17% of mean flow. The mean run-off per square mile of drainage area at Henniker between 1960 and 1969 was .98 mgd, and at Penacook .94 mgd. Because the drainage area at Henniker, the lower Contoocook River relative to the upper river, experiences a net loss on a per square mile basis of water during some periods of the year, likely from greater evaporation from the more level terrain and perhaps some reverse ground water induction through the streambed into the adjacent sand and gravel. In absolute numbers, the 1960-1969 average mean flow of the Contoocook River at Henniker was 361.2 mgd. The 10-year mean high-flow was 827% of the average mean flow, while the 10-year mean low-flow was 8.3% of average mean flow. The 10-year mean low flow is about 50% of the fish habitat support flow. The 10-year absolute minimum flow was about 19% of the fish habitat support flow. The 10-year average mean flow was 142% of the 1965 drought year flow.

At Penacook, in absolute numbers, the 1960-1969 average mean flow of the Contoocook River was 718.1 mgd. The 10-year mean high flow was 827% of the average mean flow, while the mean low flow was 10% of the average mean flow. The 10-year mean low flow is about 59% of the fish habitat support flow. The 10-year absolute minimum flow at Penacook was about 31% of the fish habitat support flow. The 10-year average mean flow was 303% of the 1965 drought year flow. The 1965 drought year average mean flow at Penacook was more than 2 times smaller in terms of its relation to the 10-year average mean flow at Penacook than the 1965 drought year average mean flow at Henniker to its 10-year average mean flow at Henniker.

The low-flow situation of the Contoocook River makes it imperative to design water management works in the basin in such a way as to reduce its yearly 2-month low-flow period so that water quality maintenance may be served.

In terms of drainage area alone, the Contoocook River valley on elevations above the floodplain is the most suitable area for intense development, with corresponding areas extending up the Blackwater and Warner River Valleys. The upper Blackwater, Warner, Beards Brook, and North Branch Contoocook Rivers can accomodate moderate developments. The hilly uplands of the basin are characterized by small tributary watersheds of less than 10 square mile drainage areas, and in terms of surface water resources management and water quality maintenance, can not accomodate development.

Protection of the Contoocook River floodplain by non-structural means is also imperative in order to enable the Edward MacDowell and Blackwater flood control projects to function optimally. Channel capacity has already been reduced from 1,000 CFS to 650 CFS due to buildings constructed on the floodplain. The New Hampshire Guide Plan has recommended that ~~the entire Contoocook and~~ part of the Blackwater Rivers, where development does not presently exist, and excluding the Hopkinton and Blackwater Reservoirs, be included in the federal Scenic and Wild Rivers System. A Scenic ~~River~~ easement along part of the Contoocook River would help in protecting the floodplain, and insure that part of the river remain free-flowing, as well as preserving its scenic qualities. To this end, the New Hampshire Guide Plan recommends that local protection of already-developed portions of the Contoocook River floodplain be protected by dikes on the floodplain or river side, and that no streambed channelization (or improvement) be done anywhere along the Contoocook River. Extensive streambed channelization in the Contoocook River can only result in reducing further the already very low low-flow volumes of the river. This would occur by increasing the velocity of river flow and by making more shallow the normal and low-flow period stream depths, thus lowering the associated stream-side ground water level, which in turn would then contribute less to base flow during the low flow periods. Low flows exacerbate water quality maintenance.

To the extent that the Corps of Engineers can influence the townships through which the Contoocook River flows to enact and enforce floodplain zoning, it should do so.

4. Ground Water - As stated, about 12% of the upper Contoocook Basin is covered by sand and gravel, and about 23% of the lower basin is so covered. The principal aquifer recharge occurs in, and ground water reservoirs are found in, sand and gravel deposits in New England. The upper Contoocook Basin can therefore be regarded as having a medium potential for ground water development, and the lower basin a high potential for ground water development in relation to other areas of the entire Merrimack Basin. Given that the Contoocook River should remain freeflowing other than the existing Hopkinton reservoir, ~~under Scenic and Wild Rivers Status~~, then groundwater development for supplemental water supply by the Contoocook River towns may become a feasible alternative in some places, particularly in the lower basin. In this regard, the effects of stream channelization for local flood protection would result in lowering the ground water reservoir capacity of the adjacent floodplain sand and gravel deposits. The sand and gravel deposits of the Contoocook River valley appear at first glance to be wide enough to be explored for conjunctive-use well fields by the induction of high flow period river stage into poorly hydraulically connected wide stream-side sand and gravel deposits, particularly north of Peterborough, south of Bennington, and south of Hillsborough, Contoocook, and Penacook.

Consistent with the managed areas for waterfowl and swimming, the Hopkinton Reservoir might also be operated by impounding more spring-flow, so as to provide low-flow augmentation to the lower Contoocook River. This possibility should be explored by the Corps of Engineers and the New Hampshire Department of Resources and Economic Development. The fish habitat flow of .25 CFS per square mile of drainage area at Penacook is 192 CFS. The 1960-1969, 10-year average mean flow at Penacook was 1,111 CFS. The objective for low-flow augmentation from Hopkinton Reservoir could be 192 CFS, the fish support flow at Penacook.

In terms of protecting the principal ground water recharge areas from recharge-disruption and pollution, floodplains and marshes should not be developed. The river bottom lands on elevations above the floodplains could accomodate limited developments, and the highlands could accomodate moderate developments. There are scattered level and deep glacial till areas, that could accomodate intense urban development with respect to ground water protection, chiefly around Wilder, Sharon, West Peterborough below the Edward MacDowell Dam, Hancock, and Hillsborough Lower Village, in the upper Contoocook River valley. In the lower Contoocook River valley, portions north of Henniker, south and west of Hopkinton Village, and at Garish corner can accomodate intense urban development with respect to ground water recharge and ground water quality protection.

The percolation capability of the soils for septic tanks is generally good in the upper Contoocook River valley other than on floodplains and marshes, with only about a 33% chance of encountering severe septic tank limitations. Henniker and Hopkinton townships however, generally have only moderate septic tank conditions, with roughly between 34% and 67% chance of encountering severe septic tank limitations. South of Penacook, and along the Contoocook River valley to Gould Hill on elevations above the floodplain is found a generally good area for septic tanks. This would suggest that for ground water pollution control there would be relatively more need for public sewer systems, if dense developments were to occur, in the lower basin downstream from Henniker than in the upper basin.

5. Fish and Game - The lower basin Contoocook River from Henniker downstream is a warm water fishery, although some warm water species may be found in the upper river as well. The upper river is a cold water fishery and contains some excellent trout streams. The Contoocook Basin is not being re-established as an anadromous fishway.

The New Hampshire Fish and Game Department has identified 6 primary waterfowl areas in the Nubanusit watershed, 3 of which are located in the Nubanusit reservoir area. There is also a primary wildfowl area near the confluence of Ferguson Brook and the Contoocook River. The New Hampshire Fish and Game Department is managing the Verney Mills Dam downstream from the Edward MacDowell Dam, and areas adjacent to the permanent pool behind the Edward MacDowell Dam spillway for wildfowl support. The new low dam north of the old Swetts Dam will also provide wildfowl support. The New Hampshire Guide Plan concurs with the present management objectives of the Corps of Engineers and the New Hampshire Fish and Game Department of providing wildfowl and aquatic wildlife support consistent with the primary objective of flood control from the Edward MacDowell Dam. The New Hampshire Guide Plan also endorses the federal Department of Agriculture, Bureau of Land Management, and the Corps of Engineers guidelines-agreement that a 300 foot public easement extend around the normal maximum pool of artificial water impoundments. The New Hampshire Guide Plan also recommends that where recreation is a significant designed benefit of an impoundment that at least one public access be provided with a boat-launch, and for every 5 miles of shoreline additional public access and boat launch sites be provided.

At the Ferguson Brook diversion, the New Hampshire Guide Plan recommends, consistent with a possible future Scenic and Recreational River status of the Contoocook River that channelization of the natural streambed of Ferguson Brook below the reservoir outlet spillway not be done. Outright purchase of the adjacent Ferguson Brook bottom land, or public easement, should be purchased by the Corps of Engineers. Allowance for public access for fishing should be provided. The boundary of the title, or easement, purchase is likely justifiable under the existing 300 foot guidelines, of up to 300 feet on either side of Ferguson Brook if needed, in order to protect the existing channelway for high-volume discharge from the Edward MacDowell impoundment.

6. Natural Resources Composite Development Capability - By putting together the individual natural resource considerations above into an over-all picture, a development capability pattern emerges that provides useful information to making resource management decisions. Excepting the actual floodplain of the Contoocook River, which is capable of accomodating agricultural, natural, and compatible light limited developments, the upper river valley around Peterborough and downstream to West Deering can accomodate moderate, i.e. residential community facilities, and community commercial land uses. An area north of Happy Valley on the east side of the river between Bennington and Antrim can accomodate intense urban developments. The river bottom land between West Deering and the Hillsborough/Henniker township line can accomodate limited development. Along this river segment however, on either side of the river on fairly level land above the river bottomland, intense urban developments can be accomodated. In the lower basin downstream from Henniker to Contoocook, on elevations above the floodplain, moderate developments generally can be accomodated. Due to the wide floodplain between Contoocook and Horse Hill, the river valley has limited development capability along this river segment. Some areas of intense urban development capable land is located northwest of both West Hopkinton and Hopkinton villages, north of the Allen State Forest, and around Penacook. Except for the Warner and Blackwater River valleys on elevations above the floodplain, and the valleys of the North Branch Contoocook River and Shedd Brook around Hillsborough Upper Village, the highlands of the Contoocook Basin are generally of a limited development capability. Scattered in these highland areas, are marshes and steep slopes that should remain natural.

7. Development Capabilities and Limitations for Land and Water - Bringing in considerations of the existing development, fish, wildfowl, and deeryards, and the surface water pattern to the Contoocook Basin natural resources composite development capability yields a development pattern useful for review of large-scale development proposals in relation to natural resource management.

In the Contoocook River valley, significant suitability for intense developments exists chiefly at Peterborough, Bennington, Antrim, Hillsborough Center, Hillsborough Lower Village, and the Gould Pond area north of Hillsborough, north of West Henniker and and Henniker, northwest of West Hopkinton, in the Blackwater River valley around the Allen State Forest, and on either side of the Contoocook River above the floodplain in Penacook west of the Merrimack River floodplain. Generally, the Contoocook River valley, except in the narrow stretch between Hillsborough Center Village and the Hillsborough/Henniker township line, can accomodate moderate development, i.e. residential, community facility and community commercial developments. Opportunity for light water-using industry exists in Peterborough, Happy Valley, between Hancock and Bennington of the west side of the Contoocook River, between Bennington and Hillsborough Center Village on the east side of the river, south of Hillsborough Lower Village, north of West Hopkinton, and on the south side of the river in Penacook.

The periodic low-flow condition of the Contoocook River limits its capability to support large water-using industry. Because the New Hampshire Guide Plan endorses the present operation of the Edward MacDowell Dam for flood control and wildlife and wildfowl management, it does not recommend any alterations to the Dam for water supply purposes. Although the New Hampshire Guide Plan does recommend that the Hopkinton Reservoir be operated to provide low-flow augmentation to the Contoocook River downstream, it does not have sufficient information at this time to recommend that this reservoir be developed for water supply. The Soil Conservation Service and the New Hampshire Water Resources Board have identified a number of potential impoundment sites in the basin, which could be used to supplement existing town public water supplies. Many of these are endorsed by the Guide Plan and are mapped on the Merrimack Basin Development Capabilities and Limitations-Water, Map. As a general policy, the New Hampshire Guide Plan recommends that the feasibility of additional water supply from ground water sources be explored

first before exploring additional surface water impoundments. The New Hampshire Guide Plan recommends further, that no additional impoundments for any purpose be constructed on the main-stem Contoocook and Blackwater Rivers, and on the Warner River on the segment with a drainage area of larger than 100 square miles.

Due to the periodic low flow situations of the Contoocook and Blackwater watersheds of between 5 and 10½ weeks a year, and the periodic very low-flow situation of the Warner River of over 10 weeks a year, the New Hampshire Guide Plan recommends that wastewater collected in these basins be treated and released in these basins where at all feasible. If future development of the Concord-Penacook area urbanizes the lower Contoocook River valley from Penacook out to the Hopkinton-Contoocook area such that an expanded regional public water supply becomes feasible, then water quality objectives could be served by drawing the additional water supply from the Merrimack River and treating the Hopkinton area wastewater adequately in the Hopkinton area and discharging into the Contoocook River. If, however, future Hopkinton-Contoocook area and West Penacook area wastewater were to be diverted out of the Contoocook Basin to Concord for treatment, and the water supplies for those areas were developed locally in the Contoocook Basin, then such a regional treatment scheme would exacerbate the low-flow situation of the lower Contoocook River. In terms of low-flow augmentation and its attendent enhancement of water quality, if future Hopkinton-Contoocook and western Penacook area wastewater is found most economical to be collected regionally and treated in Concord, its future water supply needs should be studied as to the feasibility of being acquired from the Merrimack River. Under this scheme local water supplies and other water works such as the Hopkinton reservoir, could be operated in such a way as to reduce low-flows during the summer.

B. Regional Implication of the Edward MacDowell Dam and Future Use of the Contoocook River

In order to stop the diminishment of the channel capacity of the Contoocook River any further than 350 CFS below its designed capacity of 1,000 CFS, stream-side towns should enact floodplain zoning to remove buildings in the 100 year floodplain. Dike-works may become necessary to protect some existing dwellings on the floodplain.

Scenic easement status of the Contoocook and Blackwater Rivers would help the basin's towns in meeting their floodplain protection responsibilities toward maintaining the optimum functioning of the Edward MacDowell Dam. The New Hampshire Guide Plan has identified sizeable portions of land on elevations above the floodplain that can accomodate light industrial, intense urban and moderate land-uses.

Future water supply needs in the upper basin can be satisfied by local tributary impoundments, and/or possibly conjunctive well field development in some towns. The problem of urbanization in the lower basin from Contoocook-Hopkinton eastward to Penacook and West Concord may require additional water supply from a regional supply from the Merrimack River, if a regional sewage collection system is constructed. As stated, it would be most beneficial to river flow to treat the Contoocook-Hopkinton-Penacook area wastewater locally, releasing it to the lower Contoocook basin.

A 300 foot public access belt around the Edward MacDowell Reservoir in public ownership would facilitate the management of the wildlife and wildfowl support areas within the reservoir area. This would also protect Ferguson Brook for public use.

C. Interstate Implications of the Edward MacDowell Dam

Future downstream water needs that may result from a future MDC diversion of the Merrimack River at Lowell, Massachusetts should not be solved by additional main-stem

impoundments of the Contoocook River. The consideration of multi-purpose impoundments lower in the Merrimack Basin in the Soucook, Suncook, Piscatequog and Souhegan watersheds, and or additional capacity to the Hopkinton-Everett Reservoir would appear to be more sensible than altering the developed wildlife and wildfowl habitats and the preserved natural trout habitat of the upper Contoocook River. Because the four tributary watersheds identified above all have low flow problems, water quality benefits could be realized in each of these tributary watersheds by a multi-purpose low flow augmentation structure in these tributary watersheds as well as the provision of flow to a Lowell MDC diversion. The lower reaches of the Souhegan, Piscatequog, Suncook, and Soucook Rivers are all warm water fish habitats. The New Hampshire Guide Plan as a general policy recommends that large impoundments be studied only after non-structural water resources alternatives are found not feasible.

Wherever possible, local watershed impoundments should be studied before larger tributary stream impoundments. Tributary stream impoundments of the Soucook, Suncook, Piscatequog, or Souhegan watersheds, if ever needed to maintain flow at Lowell for an MDC diversion, should also be designed and operated so as to maintain flow during the entire low-flow period of the tributary river in which they were located.

D. On-going Wastewater Studies by the New Hampshire Water Supply and Pollution Control Commission (NHWSPCC)

The NHWSPCC has a number of wastewater studies on-going in the Contoocook Basin which will have an effect upon water quality of the basin:

Merrimack River Basin Water Quality Management Plan, under Section 303E of P. L. 92-500, for attaining the required water quality for the surface waters of the Merrimack Basin as classified by the State Legislature.

Phase I (1973-1977/78)

Jaffrey - secondary treatment
Peterborough - secondary treatment
Bennington - secondary treatment
Antrim - secondary treatment
Hillsboro - secondary treatment
Henniker - secondary treatment
Hopkinton - secondary treatment
Warner - secondary treatment
Penacook - regionalize collection by including Boscowen and area west of Penacook

Phase II (1978-1985)

Jaffrey - best practical technology
Peterborough - best practical technology
Bennington - best practical technology
Antrim - best practical technology
Hillsboro - best practical technology
Henniker - best practical technology
Hopkinton - best practical technology
Warner - bext practical technology
Penacook - with regional collection, best practical technology

In general, in the Contoocook Basin the best practical technology (BPT) is to be on line by 1983. This may entail additions to existing secondary treatment plants, recycling, spray irrigation of treated wastewater, or some other form of advanced wastewater treatment.

The New Hampshire Guide Plan feels that the wastewater planning being done for the Contoocook Basin will meet water quality standards in the future without changing the present operations of the Edward MacDowell Dam. Water quality problems associated with low flow conditions will persist in this basin until adequate treatment of both municipal and industrial wastewater is accomplished. Water quality maintenance in the basin will benefit from the designing of any new water resources facilities such that low-flow augmentation is achieved from their operations. Expanded industrial use of the Contoocook River, in part, depends upon mitigating the low-flow situation in order that there may be sufficient dissolved oxygen assets during these periods to allow even best practical technology to meet state water quality standards. Scenic [redacted] status of those segments of the Contoocook River not presently urbanized would help insure that state water quality standards are met in the future.

E. The Status of Official New Hampshire Response to the Corps of Engineers Edward MacDowell Dam Letter

The New Hampshire Office of Comprehensive Planning has forwarded copies of the letter to resource agencies in the state: Fish and Game Department; Water Resources Board; Water Supply and Pollution Control Commission; Department of Resources and Economic Development; and Department of Public Works and Highways. These agencies have, or will, write a response directly to the Corps of Engineers if they want to.

AWD:jmb

cc: Arthur Newell
William Fuller
Charles Rossell

STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
JOHN O. MORTON BUILDING CONCORD, N.H. 03301

ROBERT H. WHITAKER
COMMISSIONER

January 24, 1974

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
N.E. Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

This is in response to your letter of January 4, 1974 in which you requested comments in connection with your review of the operation of the Edward MacDowell project in Peterborough.

The Department's Planning and Economics and Design Divisions have reviewed this matter and we pose one question concerning the change in channel capacity in Nubanusit Brook. For details of this question, please refer to the attached interdepartment communication dated January 17, 1974 signed by H. E. Roberts, the Department's Highway Design Engineer. Further comment is reserved until the information requested in this letter has been received and analyzed.

Sincerely,

R. H. Whitaker, P.E.

RHW/ab

cc: B. H. Langley, Assistant Chief Engineer
E. W. Huckins, Assistant Chief Engineer
H. E. Roberts, Highway Design Engineer

STATE OF NEW HAMPSHIRE

INTER-DEPARTMENT COMMUNICATION

DATE January 17, 1974

FROM H. E. Roberts AT (OFFICE) Highway Design Division

SUBJECT EDWARD MACDOWELL DAM - NUBANUSIT BROOK
FLOOD CONTROL - MERRIMACK RIVER

TO Mr. B. H. Langley
Asst. Chief Engineer

MEMO

Reference is made to your memo dated January 9, 1974 concerning the letter from Mr. John Leslie of the Corps of Engineers, 1/4/74.

Review of the Corps' letter indicates that by changing the safe channel capacity in Nubanusit Brook from 1,000 to 650 c.f.s. they might be increasing the discharge into Ferguson Brook. If this is so, what will the new volume of water be in Ferguson Brook for a Standard Project Flood and how will it affect the bridges carrying U. S. Route 202 and Route 123 over Ferguson Brook in Hancock, New Hampshire?

If the flow in Ferguson Brook is not increased, we assume that the Standard Project Flood must have changed since inception of the Dam.

More detailed information on the flow in Ferguson Brook and/or the Standard Project Flood are required so we may determine whether or not your proposed actions will have any adverse impact on the existing highways.

H. E. Roberts
Highway Design Engineer

HER/sem

NEDED-W 15 February 1974

Mr. R. H. Whitaker
New Hampshire Department of
Public Works and Highways
John O. Morton Building
Concord, New Hampshire 03301

Dear Mr. Whitaker:

This is in response to your letter of 24 January 1974 concerning the review of operation at Edward MacDowell Dam in Peterborough, New Hampshire.

The location of the spillway at MacDowell reservoir is unique in that it is not at the main dam, but situated on the watershed divide at Halfmoon Pond. Consequently, when spillage occurs, flows are diverted from the Nubanusit Brook watershed to Davis Brook in the Ferguson Brook watershed and then into the Contoocook River. At the time MacDowell Dam was constructed, Bennington Reservoir was an authorized project and its pool would have backed up Ferguson Brook; therefore, flowage easements were considered unnecessary. However, the Hopkinton-Everett reservoir complex located further downstream on the Contoocook River was substituted for the Bennington project.

The Corps of Engineers is responsible for any damages resulting from uncontrolled spillway discharge from MacDowell Dam. As a result of this responsibility, it is considered necessary to prevent further encroachment on lands along Ferguson Brook that would be inundated during a standard project flood (SPF). An SPF is a synthetic flood developed by the Corps of Engineers to demonstrate the most severe flood that is reasonably characteristic of a region.

The pool at MacDowell can be expected to reach spillway crest elevation (946.0 feet msl) on a recurrence interval of approximately

35 years. The previously mentioned SPF has a recurrence interval in excess of 100 years.

The 1,000 cfs safe downstream channel capacity, mentioned in our original letter, was an estimate based on historical flows at the U.S. Geological Survey gage on Nubanusit Brook and was used as a planning tool only. However, since completion of the project, it has been found that normal safe channel capacity is in the order of 650 cfs due to development adjacent to the riverbanks. During major events, such as a recurrence of the March 1936 or September 1938 floods, releases could reach as high as 700 cfs. A flow of 650 cfs has been exceeded three times in the 23 years since completion of the project.

The SPF, developed for the MacDowell review, resulted in a peak inflow of 15,000 cfs with a volume of 19,500 acre-feet, equivalent to 8.9 inches of runoff from the contributing 43.7 square mile drainage area. Uncontrolled spillway discharge with a peak of 2,900 cfs would flow into Ferguson Brook approximately 36 hours after beginning of rainfall excess. For comparison purposes, a recurrence of the record 1938 flood would produce a peak spillway discharge of approximately 1,200 cfs.

It is estimated that during an SPF the peak flow of 3,300 cfs from the local 9.5 square mile drainage area would occur 18 hours after the storm. This is about 100 cfs higher than would occur from a combination of spillway discharge from MacDowell and the local contribution at that time.

Route 123 in the vicinity of Ferguson Brook, presently owned by Mr. Albert Daloz, would be overtopped by our SPF, however Route 202 would not be affected.

Sincerely yours,

JOHN WM. LESLIE
Chief, Engineering Division

TOWN OF

Peterborough, New Hampshire

OFFICE
BOARD OF SELECTMEN

January 28, 1974

Mr. John Wm. Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Mass. 02154

Dear Sir:

Your letter of January 4, 1974 has been in our hands for some time and we apologize for the delay in replying. However, we have wished to obtain possible comments from other agencies of the Town such as the Conservation Commission and are awaiting such contributions.

In the meantime, we might comment that your review of the Edward MacDowell project is much appreciated. Specifically, we are aware of the following situations with which you may or may not be concerned in your study.

A number of naturalists have indicated to us that a slight additional impoundment of waters up stream of the MacDowell Dam would be distinctly advantageous with respect to the wildlife ecology.

Although not necessarily included in your study, the effects of the confluence of the Nubanusit with the Contoocook are continuously under observation in this town. As the Contoocook flows northward from this point, its progress becomes increasingly impeded as it approaches the dam at North Peterborough. Up stream of this dam there has occurred a great amount of silting. Certain properties are frequently damaged because of high water along this course. The dam is privately owned and is in very poor condition. For ecological, aesthetic and recreational reasons, the Town is interested in maintaining a certain impoundment up stream of the dam. Due to siltation, however, any such impoundment would of course be extremely shallow.

We would appreciate your advice with regard to the above observations.

You mention that the safe channel capacity down stream of the MacDowell Dam has been reduced to 650 csf and that although this decrease does not adversely affect the project regulation, measures will be taken to maintain the present capacity. We concur with the necessity to do so and we would be interested in your explanation as to what sorts of measures would be effective and how we might be able to assist.

Very truly yours,

James E. Simonds, Chairman
BOARD OF SELECTMEN

JES:t

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
John W. McCormack Post Office and Courthouse
BOSTON, MASSACHUSETTS 02109

FEB 5 1974

Division Engineer
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Sir:

This is in reply to Mr. Leslie's letter of January 4, 1974, (NEDED-R), concerning the review of the Edward MacDowell project at Peterborough, New Hampshire. We understand that use-emphasis of the area has shifted from management for recreation to management for fish and wildlife. In this regard we suggest that a Fish and Wildlife Management Plan be worked out with the New Hampshire Fish and Game Department. Any such Plan should consider the following alternatives:

1. Selective timber harvesting.

2. Creation of clearings, brush cutting, and wildlife vegetative plantings for small game improvement (rabbit, grouse and woodcock).

3. Preservation of unique ecological types of vegetation (climax stage of mature trees, etc.).

4. Enhancement of stream habitat for game fish species, Nubanusit and Stanley Brooks above pool areas (overhanging trees, groins, gabions, weirs, etc.).

5. Holding main pool at elevation 912' or 915' throughout the year to set vegetative succession back.

6. Impoundment structure on Stanley Brook to create wildfowl marsh.

7. Impoundment structure at Dinsmore Pond area to create wildfowl marsh.

8. Wildlife habitat enhancement vicinity of Beaver Pond.

We would be happy to discuss this plan with representatives from your agency and the New Hampshire Fish and Game Department.

Thank you for the opportunity to comment on the project.

Sincerely yours,

Richard E. Griffith

Regional Director

NEW HAMPSHIRE DEPARTMENT of RESOURCES and ECONOMIC DEVELOPMENT

GEORGE GILMAN
COMMISSIONER

February 7, 1974

Mr. John William Leslie
Chief, Engineering Division
Department of the Army
New England Division, Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

This is in response to your letter of 4 January 1974, regarding the Edward MacDowell Flood Control Reservoir.

In view of our current commitments, levels of operational funding, and projected priorities (one of which is the Hopkinton-Everett Reservoir), there seems very little likelihood of this Department becoming actively involved with MacDowell's water resource needs or environmental improvement projects for as far ahead as we can envision.

We do, of course, welcome the considerable information which your letter conveys. While we might not directly participate in projects at this particular site, we would be interested in learning of any major proposals which are developed.

Sincerely,

George Gilman
Commissioner

GG:c

cc: Division of Parks

TOWN OF

Peterborough, New Hampshire

OFFICE
BOARD OF SELECTMEN

PETERBOROUGH CONSERVATION COMMISSION

February 14th, 1974

Mr. James E. Simonds
Board of Selectmen
Town of Peterborough, New Hampshire

Dear Jim:

In view of our conversation about the recent letters from the Corps of Engineers, describing their actions to improve conditions at the Edward MacDowell Dam as well as upstream and down stream, I am offering these comments after discussing them with the Conservation Commission yesterday.

While the Corps states confidently that a spillway discharge of 650 cfs in time of excess run-off marks, at this date, the safe channel capacity, I question the flooding that could take place - most likely into Evans Flats - as well as overflowing of the present constricted banks of Nubanusit Brook with an emergency discharge of 800 cfs as they cite.

The choke point, of course, is the "Phoenix Mill" Dam at Elm Street acting in the manner of a weir; the question is what height of the crest above normal flow over this dam would be necessary to pass the 800 cfs. The commensurate contour line projected upstream would then indicate all adjacent property subject to such flood damage.

Fill as it now exists at various points along the brook's channel will naturally increase the velocity of flow at flood stages, and where this flow is diverted at any bend in the stream the current would aggravate erosion and washouts. The Corps' letter mentions taking measures to preserve a channel capacity of 650cfs, but we should also be told what precautions are included to minimize flood damage at 800cfs, the 100-year emergency level. As stated in their letter all these considerations should be reckoned with in adopting zoning regulations for our flood prone areas.

Similarly I would ask consideration as to the safe flooding limits below the Phoenix Mill Dam where confluence with an equally flooded Contoocook River would cause a choke point and consequent flooding of the Grove Street - Depot Square area as occurred in 1936 and 1938.

For the sake of our Master Plan and suitable flood plain ordinances for the township the Corps of Engineers should provide Peterborough with flood profiles for the entire length of the Contoocook River within the township. I understand that this was to be included in their report scheduled for July, 1974; not just the Nubanusit Brook alone. I hope you can get their assurance of these profiles as well. All of this work, they say, is being done as a part of the comprehensive plan for flood control in the Merrimack River Basin. Hancock officials, I am told, have been assured of the flood profile within their township.

Should Peterborough wish to reinforce the "North Dam" by making it an earth fill structure, as I have mentioned before, what position would the Corps take in view of their rights to control the spillway gates at the north end of this dam? Pos-

session of these rights shows a recognition of some responsibility for the flood in the Contoocook River as a tributary to the Merrimack Basin.

Our Commission welcomes word of the reconstruction and remedial work being done at the Verney Dam and above and below the MacDowell Dam to assure Peterborough, and the West Village particularly, of adequate safeguards under present circumstances, at a time of flood emergency. It is of note that the Corps' representative has already approached property owners along Ferguson Brook in Hancock, seeking easements on land downstream of the spillway, anticipating additional overflowing to compensate for the reduced maximum release rate at the MacDowell.

It would help our Commission to have the answers to these questions; surely the whole town would benefit in the long run.

Sincerely,

Fairfield

Fairfield E. Raymond, Chairman
Peterborough Conservation Commission

DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
MANCHESTER AREA OFFICE
DAVISON BUILDING, 1230 ELM STREET
MANCHESTER, NEW HAMPSHIRE 03101

REGION I
Room 800
n F. Kennedy Federal Building
Boston, Massachusetts 02203

FEB 20 1974

IN REPLY REFER TO:
1.3PMC (Sieminski)

RE: NEDED-R

Mr. John Wm. Leslie
Chief, Engineering Division
New England Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

With reference to your letter of January 4, 1974, regarding the Edward MacDowell project, please be advised that this agency has recently issued a firm committment for 54 units of 221-d(4) upper income housing in West Peterborough.

The specific housing site abuts the west bank of Nubanusit Brook and is located at the northeasterly intersection of Union and Wilder Streets, approximately ¼ mile southerly of the main flood control structure. It is my understanding that the housing site is not on the flood plain, and that our agencies have cooperated in discussions regarding protection of the site through flow regulation.

Any modifications to the current system should consider this housing project, and the protection of other non-assisted urban development in Peterborough and the remainder of the Contoocook River Valley.

In terms of other public purposes served by this facility, please refer to the comments made in our letter of January 2, 1974 regarding the Franklin Falls project. As was the case with that correspondence, we have provided a copy of your letter to the Southwestern New Hampshire Regional Planning Commission. They should comment directly to you regarding the specific merits of the Edward MacDowell project.

Should you have any questions, please do not hesitate to contact Arthur V. Tonini, Assistant Director for Planning and Relocation, at (603) 669-7011, extension 7641/2.

Sincerely,

Creeley S. Buchanan

Creeley S. Buchanan
Area Director

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
John W. McCormack Post Office and Courthouse
BOSTON, MASSACHUSETTS 02109

Division Engineer
New England Division
U. S. Army Corps of Engineers
424 Trapelo Road
Waltham, MA 02154

Dear Sir:

Attached is a copy of a letter from the New Hampshire Fish and Game Department regarding the Edward MacDowell project at Peterborough, New Hampshire. These comments were received pursuant to the release of our February 5, 1974 report on the project.

The New Hampshire Fish and Game Department concurs with our report. We agree with their assertion that an overall management plan will be needed for the area.

Sincerely yours,

ACTING Regional Director

Attachment

STATE OF NEW HAMPSHIRE
FISH AND GAME DEPARTMENT
34 BRIDGE STREET
CONCORD, N.H. 03301

BERNARD W. CORSON
DIRECTOR

January 17, 1974

John Wm. Leslie, Chief
Engineering Division
Department of the Army
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

This will acknowledge your communication dated January 4 with reference to the Edward MacDowell Dam project at Peterborough, New Hampshire. Please be advised that our department hopes to renew its management license for the MacDowell Reservoir. We are interested in whatever management for waterfowl can be accomplished at the pool immediately above the dam. Our major interest is in the marsh upstream from the bridge where we are considering construction of a subimpoundment for waterfowl and aquatic furbearers with the upland being managed for forest game.

On page 2, second paragraph, it is stated that measures will be initiated to maintain the present 650 cfs channel capacity. If the measure is to zone the flood plain and acquire easements to prevent further development, it is recommended that easements include fishing easements also. If the measure is to channel the stream, we would be opposed to this method.

Thank you for giving us the opportunity to comment on this matter.

Sincerely yours,

Bernard W. Corson
Director

BWC:fgh

Peterborough Industrial Development Corporation

PETERBOROUGH • NEW HAMPSHIRE 03458

Telephone: 603 924-7121

KENNETH A. BRIGHTON
President

GEORGE W. WALSH
Executive Vice-President

RICHARD W. PIERCE
Treasurer

February 28, 1974

Department of the Army
New England Division,
Corps of Engineers
424 Trapelo Road
Waltham, Mass. 02154
Att: Mr. Finegan

RE: Brookside Apartments
Peterborough, N. H.

Dear Mr. Finegan:

As discussed in our recent telephone conversation, I am sending you our plans for the Brookside Apartments for your consideration as to any possible affect in the operation of the MacDowell Dam.

At this time I would also confirm our permission for the Corps of Engineers to control the Verney Dam at any time they feel necessary to insure a proper flow from the MacDowell Dam. I will give a key to the lock on the control to Mr. Rathborn.

I would appreciate your earliest consideration of this matter as we have tenatively scheduled our closing for March 11.

Very truly yours,

P. I. D. C.

George W. Walsh

George W. Walsh
Executive Vice-President

GWW/sd

P. S. The Brookside plans are being mailed under separate cover.

STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
JOHN O. MORTON BUILDING

OBERT H. WHITAKER, P.E.
COMMISSIONER

CONCORD, N.H. 03301

March 12, 1974

Mr. John Wm. Leslie
Chief, Engineering Division
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts 02154

Dear Mr. Leslie:

This is in response to your letter of 15 February 1974 concerning the review of operations at Edward MacDowell Dam in Peterborough.

Our Design Division has reviewed the information furnished in your letter and have concluded that there will be no adverse affects upon the highways in question as a result of your proposed operations.

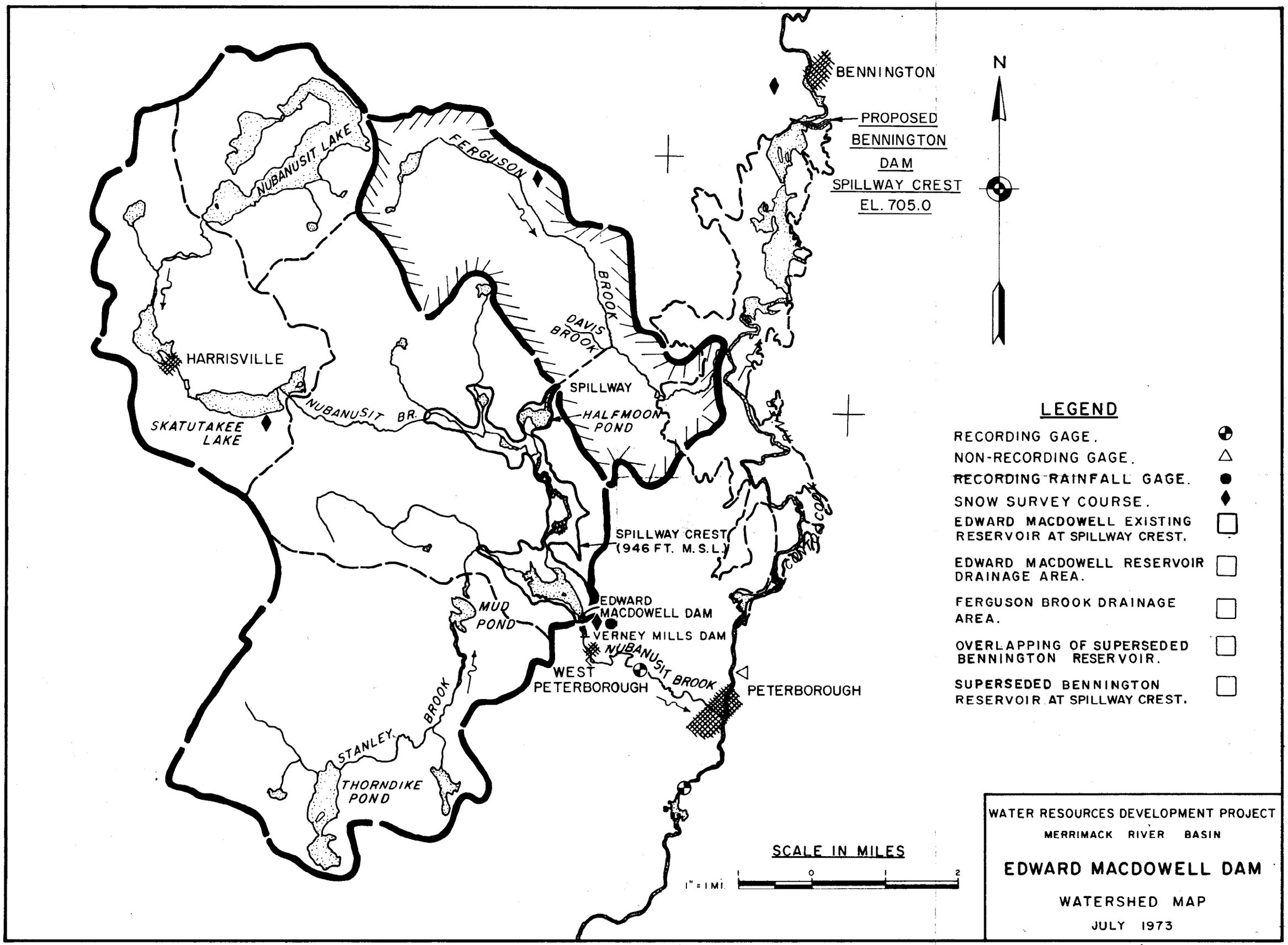
Thank you for inviting our comments on this matter.

Sincerely,

R. H. Whitaker, P.E.

RHW/ab

cc: Design Division



WATER RESOURCES DEVELOPMENT PROJECT

MERRIMACK RIVER BASIN

EDWARD MACDOWELL DAM

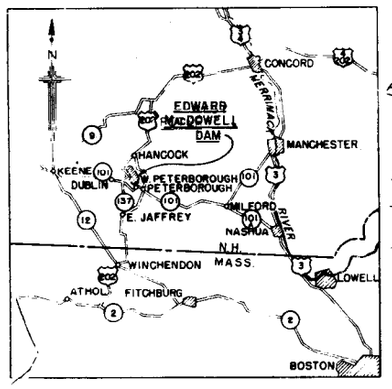
WATERSHED MAP

JULY 1973

PLATE I

CORPS OF ENGINEERS

U. S. ARMY



VICINITY MAP

SCALE IN MILES

10 0 10 20

Ferguson Brook

725 150 800 840 850 870 875

To Peterborough

MIDDLE HANCOCK ROAD

℄ SPILLWAY CHANNEL

900 910 920 925 935 940 950 960 975 1000 1020

DIKE

SPILLWAY CREST EL. 946.0

TOWN OF HANCOCK
TOWN OF PETERBOROUGH

To West Peterborough

WINDY ROW

LIMIT OF GOVERNMENT OWNED LAND

PROPOSED SUB-IMPOUNDMENT

HALFMOON POND

SARGENT SCHOOL CAMP

BROOK

CLUBBY SCOTT RD

WEST SIDE ROAD

FLOW LINE AT SPILLWAY CREST EL. 946.0

To Peterborough

WEST PETERBOROUGH

To Hancock

HILLSBORO CO.
CHESHIRE CO.
TOWN OF HANCOCK
TOWN OF HARRISVILLE

BEAVER POND

NUBANUSIT BROOK

DINSMORE POND

HALFMOON POND ROAD

SWETTS DAM

PERMANENT POOL

El. 912±

HARRISVILLE ROAD

DAM
SPILLWAY CREST, EL. 946.0

VERNEY MILLS DAM
SPILLWAY CREST EL. 909.65

HILLSBORO CO.
CHESHIRE CO.
TOWN OF PETERBOROUGH
TOWN OF DUBLIN

To Peterborough

To Dublin

FLOW LINE AT SPILLWAY CREST EL. 946.0

LIMIT OF GOVERNMENT OWNED LAND

LIMIT OF GOVERNMENT OWNED LAND

TOWN OF HARRISVILLE
TOWN OF DUBLIN

To E. Jaffrey

To Eastview

NOTES

Topography based on Aerial Photographic Surveys
Elevations refer to Mean Sea Level datum
Reservoir information reproduced from
Dwg. No. M78-12/79.1 dated OCT. 1947

REVISION	DATE	DESCRIPTION	BY

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

DES. BY	DR. BY	CK. BY

SUBMITTED
CHIEF, SECTION
PROJECT ENGINEER

APPROVAL RECOMMENDED
CHIEF, DESIGN BRANCH

APPROVAL RECOMMENDED
CHIEF, P. & R. BRANCH

MERRIMACK RIVER FLOOD CONTROL
EDWARD MacDOWELL RESERVOIR
RESERVOIR MAP
NUBANUSIT BROOK, NEW HAMPSHIRE

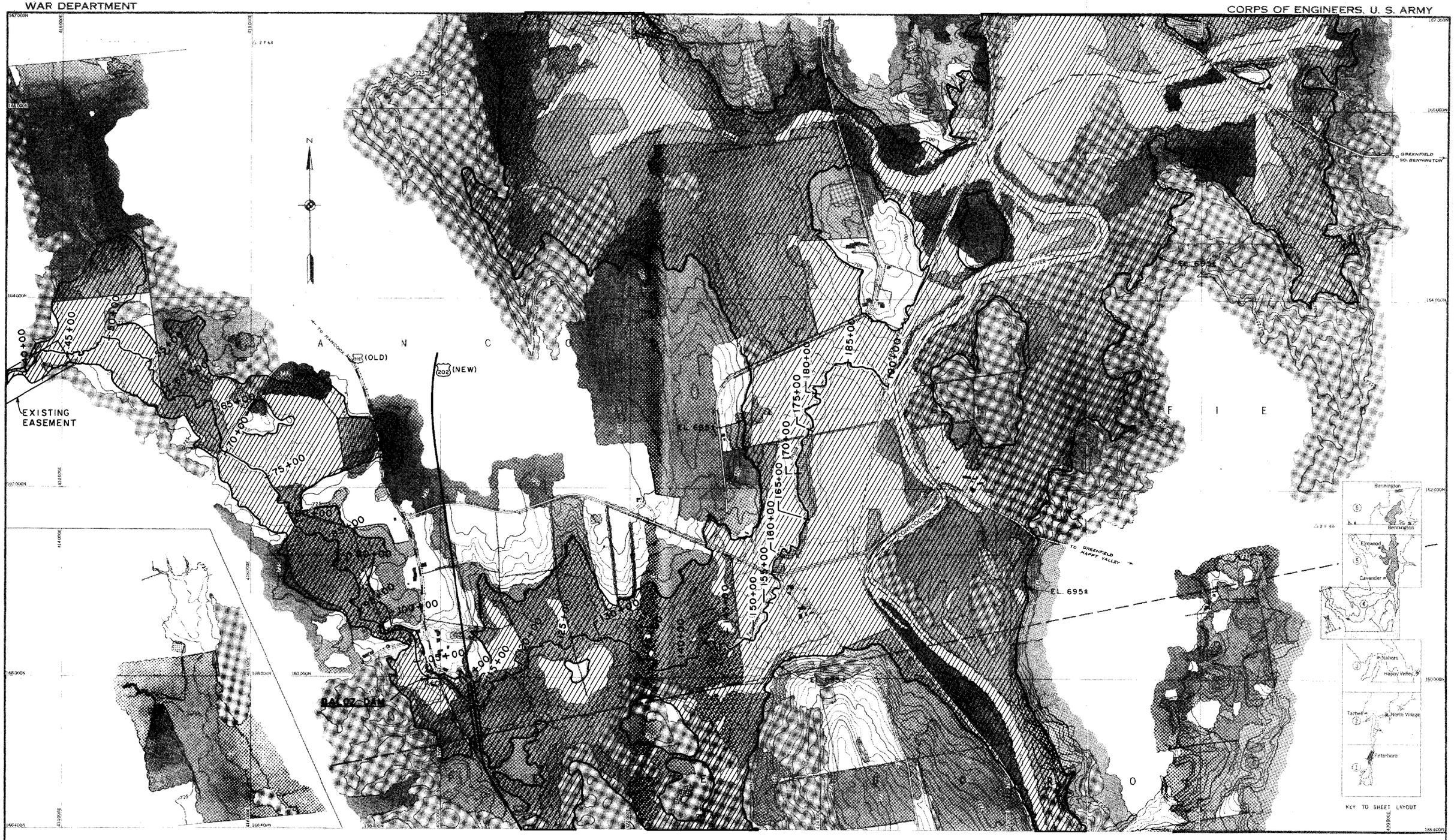
APPROVED DATE
CHIEF, ENGINEERING DIVISION

SCALE | SPEC. NO. CIV. ENG. 19-016-
DRAWING NUMBER

APPENDIX II
PLATE

WAR DEPARTMENT

CORPS OF ENGINEERS, U. S. ARMY



NOTE:
Below new Route 202 tailwater conditions approximately equal to flood of September, 1938, on Contoocook River.

PROPOSED EASEMENT

EXISTING EASEMENT

SEPTEMBER 1938 FLOOD

PLAN

E. MACDOWELL 216 STUDY

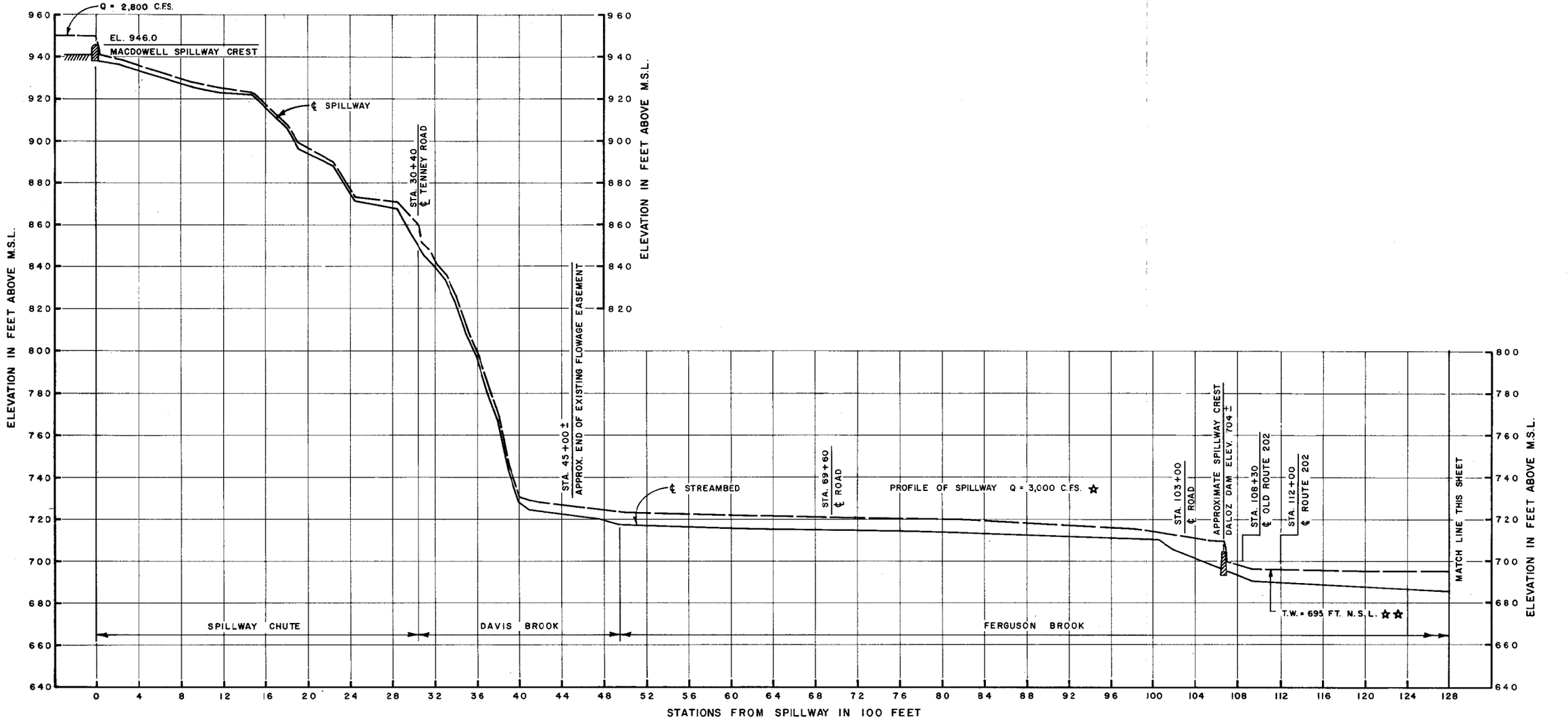
STANDARD PROJECT FLOOD

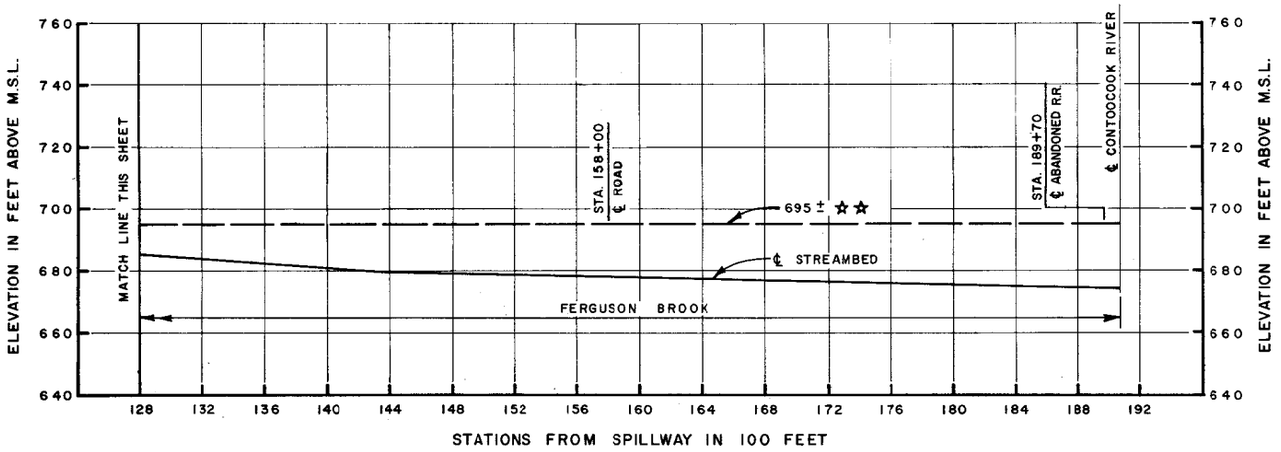
ALONG DAVIS AND FERGUSON BROOKS

JULY 1973

PLATE III

CORPS OF ENGINEERS — U. S. ARMY





NOTES:

W. C. B. RECOMMENDS EASEMENT STUDY BETWEEN STATIONS 45+00 TO 112+00

☆☆ TAILWATER CONDITIONS APPROXIMATELY EQUAL TO FLOOD OF SEPTEMBER 1938 ON CONTOOCOOK RIVER

☆ DISCHARGE COMPRISED OF 2,800 C.F.S. SPILLWAY AND 200 C.F.S. LOCAL

PROFILE

E. MACDOWELL 216 STUDY

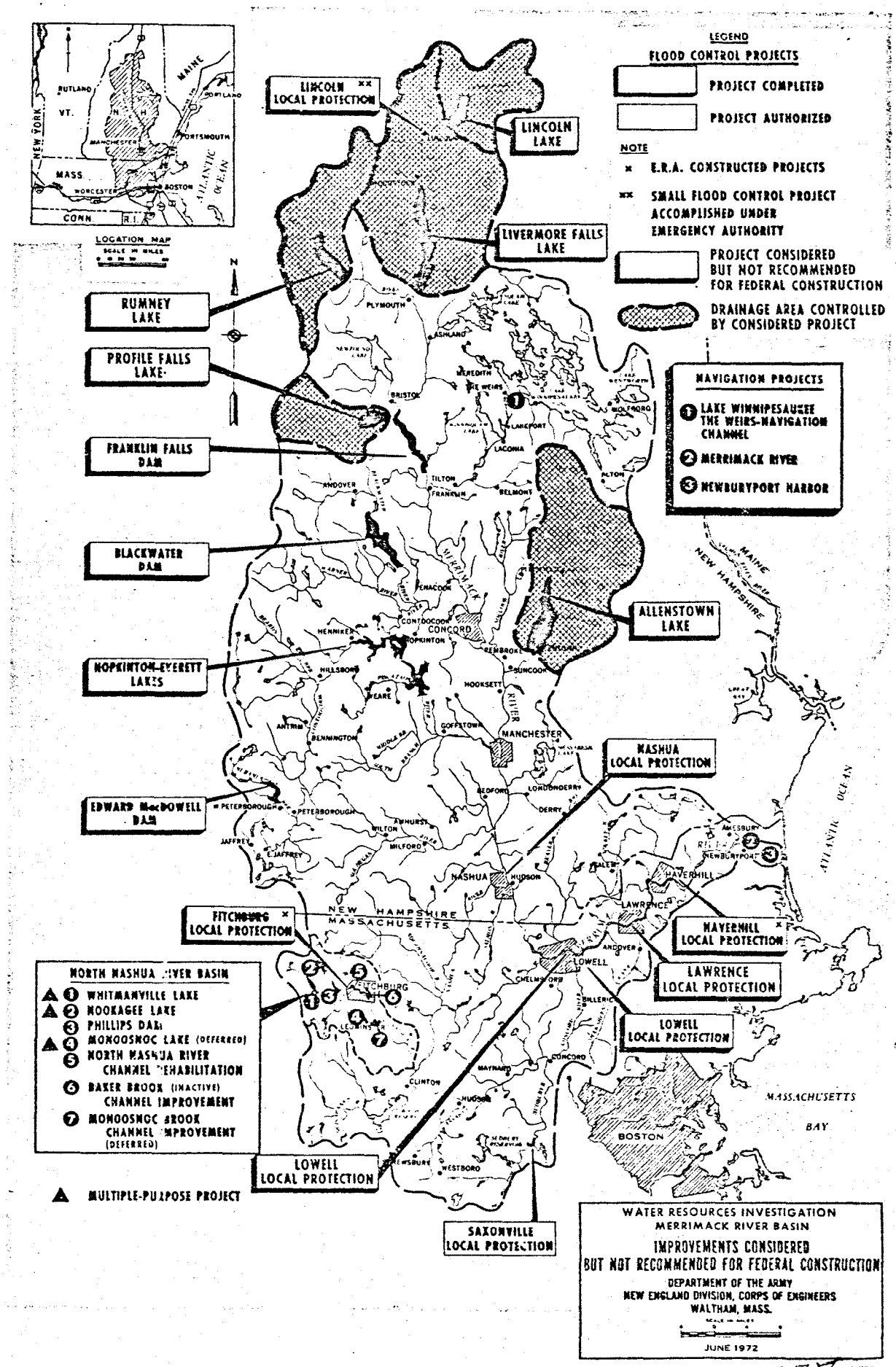
STANDARD PROJECT FLOOD

ALONG DAVIS AND FERGUSON BROOKS

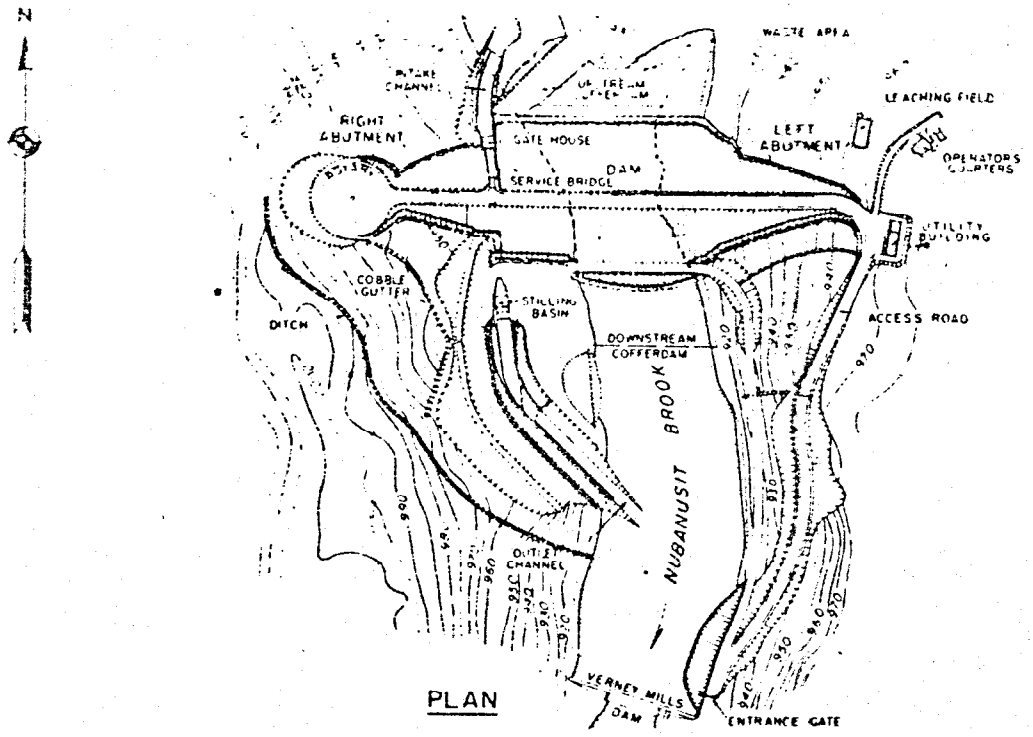
JULY 1973

ATTACHMENT IV

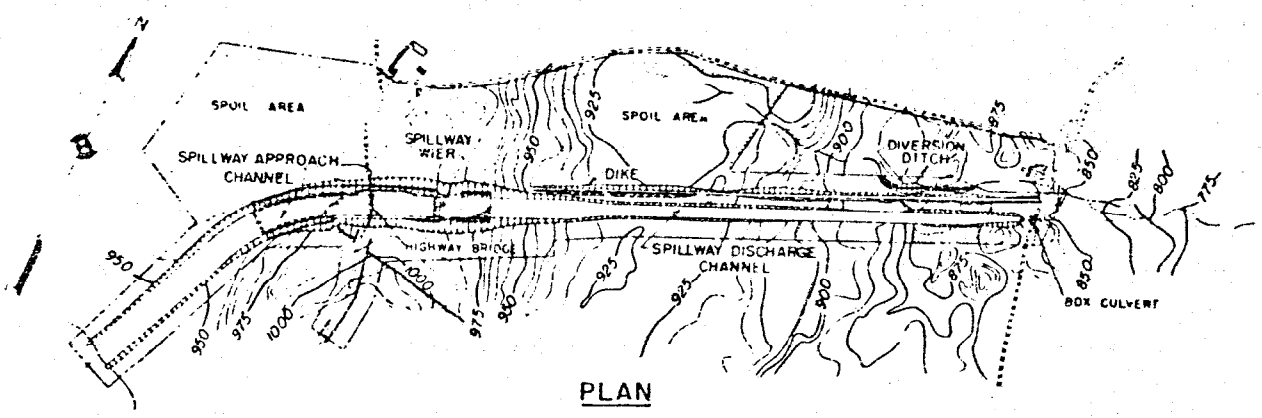
PLATE


LEGEND
FLOOD CONTROL PROJECTS
PROJECT COMPLETED
PROJECT AUTHORIZED
NOTE
× E.R.A. CONSTRUCTED PROJECTS
×× SMALL FLOOD CONTROL PROJECT ACCOMPLISHED UNDER EMERGENCY AUTHORITY
PROJECT CONSIDERED BUT NOT RECOMMENDED FOR FEDERAL CONSTRUCTION
DRAINAGE AREA CONTROLLED BY CONSIDERED PROJECT
LOCATION MAP
LINCOLN ×× LOCAL PROTECTION
LINCOLN LAKE
LIVERMORE FALLS LAKE
RUMNEY LAKE
PROFILE FALLS LAKE
FRANKLIN FALLS DAM
BLACKWATER DAM
HOPKINTON-EVERETT LAKES
EDWARD MacDOWELL DAM
FITCHBURG × LOCAL PROTECTION
LOWELL LOCAL PROTECTION
SAXONVILLE LOCAL PROTECTION
NASHUA LOCAL PROTECTION
HAVERHILL × LOCAL PROTECTION
LAWRENCE LOCAL PROTECTION
LOWELL LOCAL PROTECTION
ALLENSTOWN LAKE
NAVIGATION PROJECTS
1 LAKE WINNIPESAUKEE THE WEIRS-NAVIGATION CHANNEL
2 MERRIMACK RIVER
3 NEWBURYPORT HARBOR
NORTH NASHUA RIVER BASIN
1 WHITMANVILLE LAKE
2 NOOKAGEE LAKE
3 PHILLIPS DAM
4 MONOOSNOC LAKE (DEFERRED)
5 NORTH NASHUA RIVER CHANNEL REHABILITATION
6 BAKER BROOK (INACTIVE) CHANNEL IMPROVEMENT
7 MONOOSNOC BROOK CHANNEL IMPROVEMENT (DEFERRED)
▲ MULTIPLE-PURPOSE PROJECT
WATER RESOURCES INVESTIGATION
MERRIMACK RIVER BASIN
IMPROVEMENTS CONSIDERED BUT NOT RECOMMENDED FOR FEDERAL CONSTRUCTION
DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.
JUNE 1972
PLATE 5
MERRIMACK
NEW HAMPSHIRE
MASSACHUSETTS
MAINE
ATLANTIC OCEAN
MASSACHUSETTS BAY
BOSTON
CONCORD
MANCHESTER
NASHUA
LOWELL
LAWRENCE
HAVERHILL
NEWBURYPORT
FITCHBURG
PLYMOUTH
LACONIA
ALTON
BELMONT
TILTON
FRANKLIN
ANDOVER
HENNIKER
HILLSBORO
PETERBOROUGH
JAFFREY
WILTON
MILFORD
AMHERST
NEW IPSWICH
TEMPLE
WESTBORO
HUDSON
MAYNARD
CLINTON
LUNENBURG
GROTON
BILLERICA
CHELMSFORD
DERRY
LONDONDERRY
SALEM
AMESBURY
SEABROOK
HAMPTON
RYE
NEW YORK
VT.
MASS
CONN
R.I.
RUTLAND
PORTLAND
PORTSMOUTH
WORCESTER

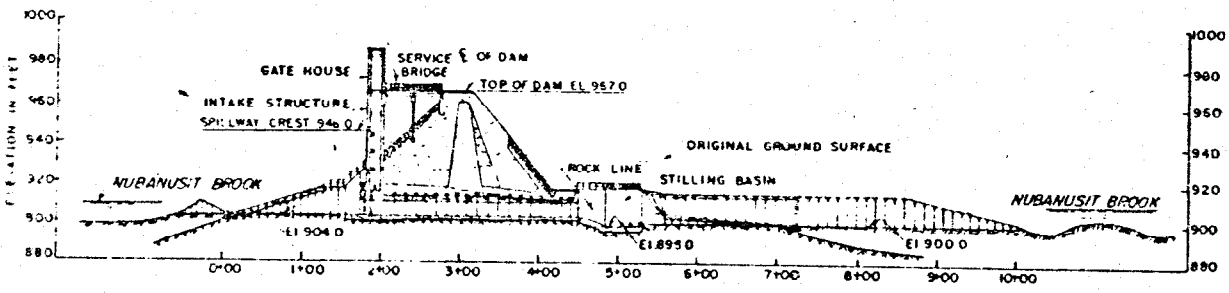
20a



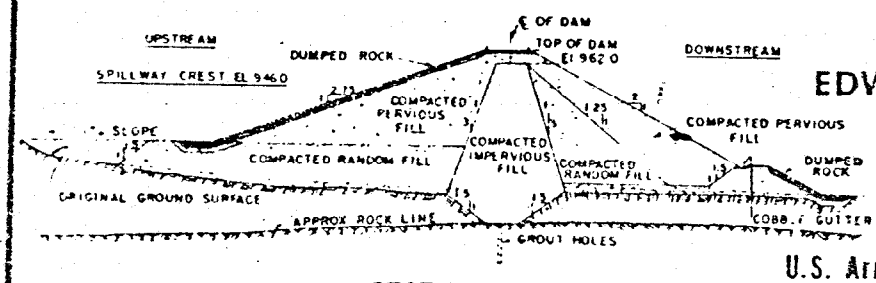
PLAN



PLAN



PROFILE ON ℄ OF CONDUIT



SECTION AT STA. 7+18

MERRIMACK RIVER FLOOD CONTROL

EDWARD MAC DOWELL DAM

PLAN & SECTIONS

NUBANUSIT BROOK NEW HAMPSHIRE

30 JUNE 1963

NOT TO SCALE

U.S. Army Engineer Division, New England
Corps of Engineers Waltham, Mass.

PLATE VI